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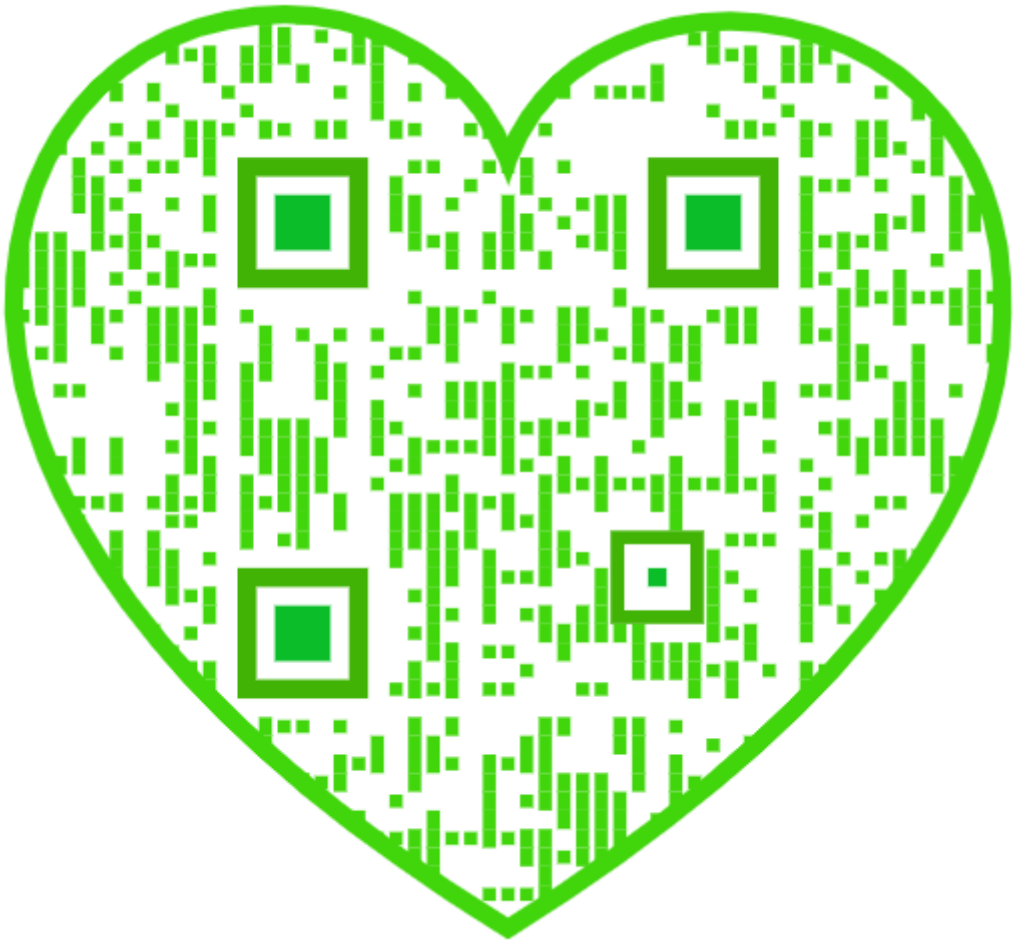

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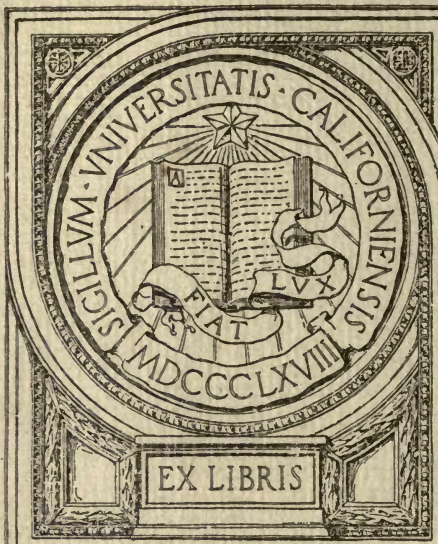

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PHILIPPINE CRAFTSMAN REPRINT SERIES
No. 1

PHILIPPINE MATS

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THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF PUBLIC INSTRUCTION
BUREAU OF EDUCATION

MANILA
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1913

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ANNUAL REPORTS:

First Annual Report of the Superintendent of Public Instruction, 1901. (Edition exhausted.)
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Fourth Annual Report of the General Superintendent of Education, 1904. (Edition exhausted.)
Fifth Annual Report of the General Superintendent of Education, 1905. (Not issued in printed form.)
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Tenth Annual Report of the Director of Education, 1910. (Supply limited.)
Eleventh Annual Report of the Director of Education, 1911.
Twelfth Annual Report of the Director of Education, 1912.

BULLETINS:

1. The Philippine Normal School. Catalogue for 1903-4. English and Spanish. April, 1904. (Obsolete.)
2. A Course of Study in Vocal Music for Vacation Normal Institutes. May, 1904. (Edition exhausted.)
3. The Philippine School of Arts and Trades, Prospectus for 1904-5. English and Spanish. June, 1904. (Obsolete.)
4. The Philippine Nautical School, Prospectus for 1904-5. English and Spanish. June, 1904. (Obsolete.)
5. Notes on the Treatment of Smallpox. June, 1904.
6. Reports of Industrial Exhibits of the Philippine Schools at the Louisiana Purchase Exposition. June, 1904.
7. Courses of Instruction for the Public Schools of the Philippine Islands. June, 1904. (Obsolete.)
8. Cursos de Enseñanza para las Escuelas Públicas de las Islas Filipinas. (Spanish edition of Bulletin No. 7.) June, 1904. (Edition exhausted.)
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10. Government in the United States. (Prepared for use in the Philippine Public Schools.) June, 1904.
11. Courses in Mechanical Drawing, Woodworking, and Ironworking for Provincial Secondary Schools. June, 1904. (Obsolete.)
12. Advanced and Post-Graduate Studies Offered by the Philippine Normal School for Preparation for Entrance to American Colleges and Universities or to the University of the Philippines. English and Spanish. August, 1904. (Obsolete.)
13. Not issued in printed form.
14. The School Law of the Philippine Islands, as Amended by Acts of the Philippine Commission to and including Act 1530, with Executive Orders and Attorney-General's Opinions Affecting the Bureau of Education. January, 1906. (Obsolete.)
15-20. Not issued in printed form.
21. Philippine Normal School. Catalogue for 1904-5. English and Spanish. May, 1905. (Obsolete.)
22. Lessons on Familiar Philippine Animals. August, 1905. (Edition exhausted.)
23. Standard Course of Study in Vocal Music for the Public Schools of the Philippine Islands. 1906. Revised and re-issued in 1910. (Editions exhausted.)
24. Outline of Year's Course in Botany and Key to the Families of Vascular Plants in the Philippine Islands. August, 1906. Revised and re-issued in 1907. Third edition issued in 1908. Fourth edition issued in 1911.
25. Official Roster of the Bureau of Education, corrected to March 1, 1906. May, 1906. (Obsolete.)
26. High School and Secondary Courses of Instruction. June, 1906. (Obsolete.)
27. Philippine Normal School. Catalogue for 1906-7 and Prospectus for 1907-8. May, 1907. (Obsolete.)
27 (A). Philippine Normal School, Courses of Study, Secondary Course. January, 1908. (Obsolete.)
28. The Milkfish or Bangos. May, 1908. (Supply limited.)
29. Constructive Lessons in English, Designed for Use in Intermediate Grades. August, 1910. Revised and re-issued, 1911. Third Edition, 1912.
30. Philippine Normal School, Catalogue for 1909-10 and Announcement for 1910-11. June, 1910. (Obsolete.)
31. School and Home Gardening. July 1910. (Now being revised.)
32. Courses in Mechanical and Free-hand Drawing, for Use in Trade and Intermediate Schools. December, 1910.
33. Philippine Hats. December, 1910. (Supply limited.)
34. Lace Making and Embroidery. December, 1910.
35. Housekeeping and Household Arts—A Manual for Work with the Girls in the Elementary Schools of the Philippine Islands. February, 1911.

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THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF PUBLIC INSTRUCTION
BUREAU OF EDUCATION

PHILIPPINE CRAFTSMAN REPRINT SERIES

No. 1

PHILIPPINE MATS

MANILA
BUREAU OF PRINTING
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FOREWORD.

The present bulletin is a reprint from The Philippine Craftsman, Vol. I, Nos. 3, 4, and 5, and is issued in this form for the purpose of placing in the hands of teachers a convenient manual for use in giving instruction in this important branch of industrial work. In it are contained directions for the preparation of materials for mat making, with suggestive color schemes for these materials and details for weaving a number of approved Philippine designs.

The use of mats for sleeping and other household purposes is universal through the extreme Orient. Suitable mat materials abound in these Islands, and when proper attention shall have been given to the artistic and decorative side of their manufacture, the mat industry may well become a source of considerable revenue in thousands of Filipino homes.

The Bureau of Education has for some years past been endeavoring to improve the designs used as well as the workmanship of Philippine mats, in order that the article produced shall be typical of the country, artistic in design, and of real commercial value. It is expected that this end will be definitely furthered through the study and use of the material contained in this reprint.

A considerable part of the subject matter of this publication is the original work of Mr. Hugo H. Miller, Mr. John F. Minier, Mr. U. S. Andes, Mr. Theodore Muller, and Mrs. Alice Brezina. Credit is also due to numerous American and Filipino teachers for the submission of reports and materials used in its preparation.

FRANK L. CRONE,
Acting Director.

MANILA, *February 1, 1913.*

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PHILIPPINE MATS

PART I

A high grade Romblon mat.

[Reprinted from The Philippine Craftsman, Vol. I, No. 3.]

PHILIPPINE MATS.

THE production of mats in the Philippines is large because of the extensive domestic demand for them. The sleeping mat [1] is used throughout the Christian provinces, and is also found among the Moros. Such mats are of the finer class and are usually more or less highly decorated with colored straws in various designs. For this purpose the buri petates are more widely produced than those made from any other material. Pandan mats are considered stronger and cooler but their use is not so extensive, probably because they are more expensive than the buri mats. In the Visayas, tikug mats are important.

Another use of mats is in the baling of two of the staple products of the Philippines, tobacco and abaca. In the Cagayan valley mats of dried banana petioles are employed. A great many of these are made in Batac, Ilocos Norte, from which place they are shipped to Cagayan. In most cases the tobacco of the Visayas is packed in such mats also. At Argao, Cebu, banana petiole mats are woven as a by-product of the sabá cloth industry. In obtaining the fiber, the outer skin of the petiole is pulled off for stripping, and the remaining portion, which is called "upag," is dried and woven into very coarse mats by children. These are called "bastos" [2] or "liplip," and are disposed of to the tobacco balers in the town, or are shipped to Cebu and other towns for baling purposes. While sabá sinamay is produced in several of the districts in the Visayas, notably in Bohol, it is not known that the upag is used for mat weaving there.

Coarse buri mats are almost exclusively used in wrapping abaca for the export trade. Since baling is carried on only in large seaports, particularly in Manila and Cebu, the weaving of these mats in certain localities where the buri palm is abundant

[1] Banig, petate, ikamen, dase. [2] Meaning coarse stuff.

Plate I. Boy carrying a bastos mat, Argao, Cebu.

and their transportation to the hemp-producing towns are important industries.

While they are not, strictly speaking, mats, plaited sacks [3] are woven in the same weave and bear the same relation to sugar and rice as do mats to tobacco and abaca. Most of the domestic rice crop entering into commerce is packed in buri sacks and practically all the export sugar is sent away in them. A few bayones are made of pandan. The production of bayones is an important industry in certain districts.

Mats are also employed throughout the provinces for drying paddy and copra in the sun, in the same manner in which trays are used for sun-curing fruit in temperate regions.

The use of the finer grades of petates for floor mats and for wall decoration is confined to the foreign population in the Philippines. Nevertheless, a considerable number is so utilized. For this trade only mats of the better grades are demanded, and the number sold for the purpose is probably considerably restricted by the fact that few mats are of suitable color combination and of proper design to satisfy foreign taste. As yet there is no known commercial export of Philippine mats. There is a considerable demand for floor mats and mats for wall decoration in Europe and in the United States, but it is improbable that the Philippines can hope to supply any part of it unless designs and color com-

Plate II. Vendors of sleeping mats.

[3] Bayones, bayong, canastro, banyot.

binations are vastly improved. Floor mats are used as rugs in the same manner as are the strips of Japanese matting which are so popular all over the world. Round floor mats, somewhat larger in diameter than the round table tops, are also in demand. Small mats can be used as doilies on the table or under the stands of flower pots and the like.

Sleeping mats and mats intended for floors, walls, stands, and mat doilies are the ones which are suitable for domestic and foreign commerce, and industrial education must interest itself in them. The Philippine materials available for weaving these mats are varied and well distributed. With improvement in color combination and design, there should be a large increase in the industry.

BLEACHING AGENTS.

Sunshine is used to bleach all mat straws, but more often they are also treated with boiling water to which certain bleaching agents have been added. Only the most important of these are explained.

Tamarind.—This tree (*Tamarindus indica*) is known in Tagalog, Bicol and Pampanga as sampalok, in Visayan as sambag, in Ilocano as salamagui, and in Palawan as kalampisao. It is a large tree with dense foliage. The leaves are employed as a bleaching agent in boiling water. It is said that the young green fruit can be used for this purpose.

Pandakaki.—The leaves of the plant (*Tabernaemontana pandacaqui*) are used as a bleaching agent. This is the name under which it is known, particularly in Pampanga and Cavite. In Palawan it is called alibetbet. It is also known as kampopot in Tagalog and as alibubut and toar in parts of the Visayas. In Ilocano the name is kurribuetbuet.

Lemons.—The juice of the various species and varieties of *Citrus* is employed to some extent for bleaching. It is usually added to boiling water in which the straw is immersed.

Vinegar.—Of Philippine vinegars, those made from palm juices are considered about half as strong as lemon juice. Vinegar from sugar cane juice has probably the same strength. That made from cooked rice is considered about one-fourth as strong as lemon juice.

Alum.—In some towns alum is added to the boiling water in which straw is treated. It is usually employed in combination with other bleaching agents.

DYES USED ON MAT STRAWS.

MORDANTS.

A mordant is a substance employed to fix the dye to the material. In general, different ones are needed for different dyes and various materials. In some cases the mordant is added to the dye liquid; in others the material is previously treated with it before being colored. The most important are the mineral mordants, such as the alumina, the iron, the tin, and the chrome. These are not used in the Philippines with local vegetable dyes. Tannin is also important and is employed to some extent in the Philippines, being generally obtained from the mangrove tan barks. Wood ashes are little used but vinegar and lemon juice are important.

Kolis.—The leaves of this plant (*Memecylon edule*) are commonly used in mordanting buri straw before dyeing it with sappan wood. In Tanay, Rizal, it is employed on sabutan straw with all of the vegetable dyes. It is known as guisian (Laguna), duigim (Ilocos, Pangasinan), kulis (Rizal, Nueva Ecija, Bataan), tagobachi (Leyte), kasigay (Ilocos Norte), agam (Negrito, Cagayan), guisoc-guisoc (Sorsogon), macaasin (Tayabas), baian (Zambales), diyatdiyatan (Tayabas), candong (Pangasinan), dioc (Pangasinan).

NATURAL VEGETABLE DYES.

Numerous natural vegetable dyes are employed in the Philippines. Those used on the mat straws are limited in number. The important ones only are here noted. The whole question of dyes is a most difficult one and hardly warrants the time which has been spent upon investigating the various dye materials, nor the effort which would be necessary to determine definitely the methods by which they can be used on mat straws. The artificial dyes have driven the natural vegetable dyes out of use because they are cheaper and are more easily applied, and because in most cases they produce more pleasing and lasting colors.

Sappan.—This plant (*Caesalpinia sappan*) is known as sapang in Tagalog and Ilocano and as sibucao in Visayan and Bicol. A beautiful dye varying from red to red-orange (see Plate III) is obtained from chips of the wood. This is employed on most Philippine fibers. Lime is sometimes used as a mordant but the straws are usually first treated with kolis leaves.

Turmeric.—This plant (*Curcuma longa*) is known as dilao

throughout the Islands. In Ilocano it is called kunig. Kalaoag is its name in Negros and Sorsogon, ange in Pampanga and duao in parts of the Visayas. The yellow dye obtained from the roots is fugitive in the sunlight.

Annatto.—This plant (*Bixa orellana*) is generally known here as achuete. It is sometimes called achiote. The plant bears burs containing many small reddish seeds, from the pulp of which the dye is obtained. It is often employed in combination with turmeric. The result is a yellow orange. The dye fades easily.

Deora.—The use of this plant (*Peristrophe tinctoria*) is confined to the Visayas and Mindanao, where it is known by this name and also as dauda and daura. In Samar the name is dala-uda. It is a small bush and is usually grown in the gardens for its leaves and tender stems. A mordant is not used. The color ranges from yellow orange to a deep red orange.

The methods of using these dye materials are explained for each straw.

MATERIALS USED WITH MUD TO OBTAIN DARK GRAYS.

Red or green straws are turned dark gray by burying them in mud to which certain substances (usually containing tannin) are added.

Talisay.—This large tree (*Terminalia catappa*) is common in the Philippines. The leaves are added to the mud in dyeing straw black. From the bark a brown dye may be obtained. It is, however, seldom used. It is universally known as talisay. Spanish speaking people call it almendras.

Indigo.—Two species of *Indigoferae* are grown in the Philippines and are known as tagum. Except with mud they are not used to dye straws.

Tiagkot.—The leaves of this plant (*Pithecolobium subacutum*) are employed on Romblon Island in dyeing buri gray. Other names are tagayong, narandauel, saplit (Cagayan); carisquis, ayamguitan (Zambales); tugurare (Pangasinan); inep (Bulacan); malasaga, malaganip, tekin (Laguna); bahay (Sorsogon); tagomtagom (Samar); tique (Rizal).

Kabling.—This plant (*Pogostemon cablin*) is generally cultivated, though it grows where its cultivation has been abandoned. A volatile oil, used to keep away insects from textiles, is obtained from the leaves. The leaves are used in Tanay, Rizal, in obtaining gray sabutan straw.

Mabolo.—The heart wood of this tree (*Diospyros discolor*) is known as kamagon. The leaves are employed in Tanay, Rizal.

Castor.—This plant (*Ricinus communis*) is seldom cultivated in the Philippines but is found wild in all localities. The "beans" yield the oil. The leaves are added to mud in obtaining gray sabutan straw.

ARTIFICIAL DYES.

It is commonly believed that artificial dyes are less permanent than natural ones. This is seldom the case; as a matter of fact, some of the fastest and most valuable dyes are now made artificially and many are not procurable from vegetable coloring matters. Most of the cheaper dyes made from coal tar are fugitive; that is, they fade in sunlight or water or in both. They are often still further cheapened by being adulterated with salt, dextrine and the like. Such are the colors which are usually sold by the Chinese tienda keepers and which have caused artificial dyes in general to come into such ill-repute in the Philippines. Many of these "Chino dyes" contain 95 per cent salt. It is the belief, however, that artificial dyes of a good class, so packed and marketed that they will come cheaply to the hands of the dyers and weavers, will drive out of use practically all of the vegetable dyes now employed in the Philippines. The disuse of the natural dyes would not be regretted here, for, with the possible exception of those obtained from sabutan straw in Tanay, much finer colors can be produced with artificial dyes, as to both beauty and fastness. If the time of the workers is considered, the vegetable dyes now employed in the Philippines are more expensive than the artificial dyes, even though the latter are now sold in wastefully small packages and bear the burden of several large profits before they come to the hands of the persons using them.[4]

DYEING.

The process of dyeing is simple. The fluid is prepared in water (usually boiling), and the material is immersed in it. The shade of color obtained depends on the length of time the material is allowed to remain in the fluid or the number of times it is treated, and the strength of the dye. The combination of two different dyes to obtain a third is understood to some extent. In particular, red and yellow are mixed to obtain orange.

[4] The Bureau of Education has taken steps to procure a series of dyes suited to each one of the mat straws and other important fibers used in household industries and industrial instruction in the Philippines.

SUGGESTIONS ON THE USE OF COLORS IN MATS.

STANDARD COLORS.

The three primary colors are red, blue, and yellow. The three secondary colors are obtained by combination of the three primary colors, and are orange, green, and violet. Orange is made by a combination of yellow and red, green is a combination of blue and yellow, and violet is the combination of red and blue. Most of the dye materials explained in the preceding pages do not produce standard colors and so, when combined, do not result in the expected secondary color. Often those called red are, in point of fact, red-violet (see Plate III). Sometimes, also, dyes called yellow are yellow-orange. A mixture of yellow-orange and red-violet would produce a muddy color. Dye called green may be really blue-green or yellow-green, and combined with red, will make a muddy color.

The above remarks on standard complementary colors are only valid for pure colors and it is only by much experimentation that pleasing tones can be obtained by a combination of the dyes used on straws in the Philippines.

HOW TO TONE DOWN BRILLIANT COLORS.

Many of the colors used in Philippine mats are very brilliant. A little brilliantly colored straw, properly combined with subdued colors such as gray or one of the natural colors of Philippine straws, is pleasing, but the abundant use of brilliant straws, such as are sometimes seen in mats of solid color, is to be discouraged.

All brilliant colors may be subdued by adding to them their complementary color. Thus a brilliant red may be subdued by adding to it a small amount of green and in the same way brilliant green may be toned down by mixing with it a small portion of red. If too much of the complementary color is added the result will be gray. As will be seen, all complementary colors will subdue one another. In Plate III the principal colors have been so arranged that the complementary colors are directly opposite each other and are connected by lines. Any two colors connected by lines on this chart will tone down each other and, if mixed in proper proportions, will result in gray.

It is probable that any straw which has been dyed too brilliant, can be closely matched to one of the colors given on Plate III. Consequently its complement can be determined and, by experimentation, the brilliant color toned down. Usually only an exceedingly small amount of its complement is needed to tone down a given color.

COLOR COMBINATION.

In general, too many different colors appear in the Philippine mats, and most of these are brilliant. It is often true that a large amount of a given brilliant color is offensive to the eye, and yet the addition of a little of it greatly enhances the beauty of the mat. Often color combinations are not harmonious. Particularly bad effects are obtained with red-violet and yellow or yellow-orange. Red-violet with blue-green is another unfortunate combination.

Certain rules have been set down for combination of colors: (1) A given color with its tints and shades [5] may always be safely combined; (2) complementary colors may always be safely combined; (3) the tints and shades of complementary colors may always be safely combined; (4) any three colors occurring in sequence on the color chart may be combined in that sequence.

The following notes on the use and combination of the colored straws from Tanay, Rizal, and from Romblon, and those shown on the charts acompanying the dyes of Leopold Cassela & Co., are given. The figures refer to the numbers given the colored straws on these charts. These dyes were evolved for the Bureau of Education especially for Philippine mat straws and will soon be available in the market. The notes have been prepared in accordance with the rules above outlined, and, if they are followed closely, no unfortunate color combination can result.

COLORS OBTAINED FROM THE NEW DYES.

The sample straws on these charts are made with the following dyestuffs:

Colors.	Numbers on chart.	Dyestuffs.
Yellow Yellow-Orange	No. 1	Paraphosphine G.
Violet	No. 2	Methylviolett BB 72 No. 1.
Brown	No. 3	Rush Brown B.
Orange Red-Red	No. 4	Rush Red S A.
Yellow-Green	No. 5	Rush Green T B.
Blue-Violet	No. 6	New Methylene Blue R.
Red-Violet	No. 7	Magenta Prima.
Black	No. 8	Rush Black M.
Chocolate	No. 9	Rush Brown X.
Red	No. 10	Rush Red J S.
Yellow Orange-Yellow	No. 11	Auramine II.
Blue-Green	No. 12	Japan Green.
Red Violet-Violet	No. 13	Methylviolett R No. 1.
Red-Orange	No. 14	Chrysoidine A G.
Blue Blue-Green	No. 15	New Methylene Blue N.
Violet Red-Red	No. 16	Safranine S 150.

[5] A tint is a paler or less intense tone than the standard color. A shade is a darker, more intense tone of the standard color.

Complementary or opposite colors on the color chart are said to be harmonious. Their relation is made more pleasing, however, if one color, usually the more brilliant, is used in very small amount. In many cases in the above combinations colors not exactly opposite have been united. They usually contain a mixture of a primary color common to both. Brown, Black, Chocolate, and Dark Red are complicated mixtures and may be analyzed with a chart which will appear later. Many of these dark colors would harmonize with one another, but would be so dark that they would not be pleasing. In every one of these combinations, the natural straw background figures as another color, and that is why the especially good combinations, as will be noticed, contain browns, yellows and reds, colors which blend particularly well with the background. Red-Violet No. 7 can be used with only a very few colors, and never with Yellow Yellow-Orange No. 1. Yellow Yellow-Orange should be used cautiously.

In sabutan straw, No. 1, Yellow, must be used sparingly. When used in combinations in place of No. 1, Yellow Yellow-Orange, the design should be an open one, rather than solid. Violet Red-Red, No. 16, when being used in place of Red, No. 10, must be used in the same way, and only in places where very, very little is called for. No. 11 is a color that clashes with even a natural straw, so is not advisable in any combination or alone. No. 13 is not a necessary color when No. 2 and No. 6 are available.

In placing the color upon the space to be decorated, the heavier colors should usually appear on the outside and near the edge of the space, although a border may sometimes be outlined with darker color on both inside and outside edges.

The following combinations of these colored straws will prove harmonious. The numbers correspond to those used on the chart and the different kinds of type indicate the proportions of the color to be used—*little,* MEDIUM AMOUNT, MUCH. The relative positions of the colors must also be observed and the given order followed when more than two colors are combined.

BROWN (3) *Yellow-Yellow Orange* (1). Especially good.

Black (8) YELLOW-YELLOW ORANGE (1).

Chocolate (9) YELLOW-YELLOW ORANGE (1).

RED-ORANGE (14) CHOCOLATE (9) *Yellow-Yellow Orange* (1). In this case, the heavy color, 9, comes in the center of the design, but is necessary to separate Nos. 14 and 1.

VIOLET (2) BLUE-GREEN (12) *Red-Orange* (14).

Violet (2) RED-ORANGE (14) BLUE-BLUE GREEN (15).

Brown (3) alone on natural background.

BROWN (3) *Yellow-Green* (5). Especially good.

Brown (3) BLUE-GREEN (12).

BROWN (3) RED-ORANGE (14) *Red* (16).

Brown (3) *Red-Orange* (14). Especially good.

Brown (3) BLUE-BLUE GREEN (15) *Red-Orange* (14). Especially good.

Brown (3) RED (16). In sabutan straw, use No. 4 or 10 in place of No. 16.

Black (8) BROWN (3) RED-ORANGE (14). Especially good.

ORANGE-RED RED (4) *Blue-Green* (12). Use No. 15 instead of 12 with sabutan.

BLUE-BLUE GREEN (15) BLUE-GREEN (12) *Orange-Red Red* (4). Especially good.

Black (8) ORANGE-RED RED (4). Especially good.

YELLOW-GREEN (5) BLUE-BLUE GREEN (15) *Red-Orange* (14).

RED-VIOLET (7) BLUE-BLUE GREEN (15) *Yellow-Green* (5). Especially good.

BLACK (8) YELLOW-GREEN (5). Use this combination with an open design (not solid), and do not use much of each.

BLUE-GREEN (12) *Yellow-Green* (5).

BLUE-BLUE GREEN (15) *Yellow Green* (5).

Blue-Violet (6). On a natural ground.

BLUE-VIOLET (6) *Red-Orange* (14).

CHOCOLATE (9) BLUE-GREEN (12) *Red-Orange* (14). Especially good.

Chocolate (9) BLUE-GREEN (12) *Red-Orange* (14). Especially good.

BLUE-BLUE GREEN (15) RED-ORANGE (14). Especially good.

BLUE-BLUE GREEN (15) *Red* (16).

ROMBLON BURI VEGETABLE COLORS.

1—Black.
2—Gray-green.
3—Natural.
4—Orange.
5—Dark red.

In Romblon buri straw the following combinations will be harmonious:

Nos. 1, 2 and 3 in accordance with Rule 4.

Nos. 2, 3 and 4 in accordance with Rule 4.

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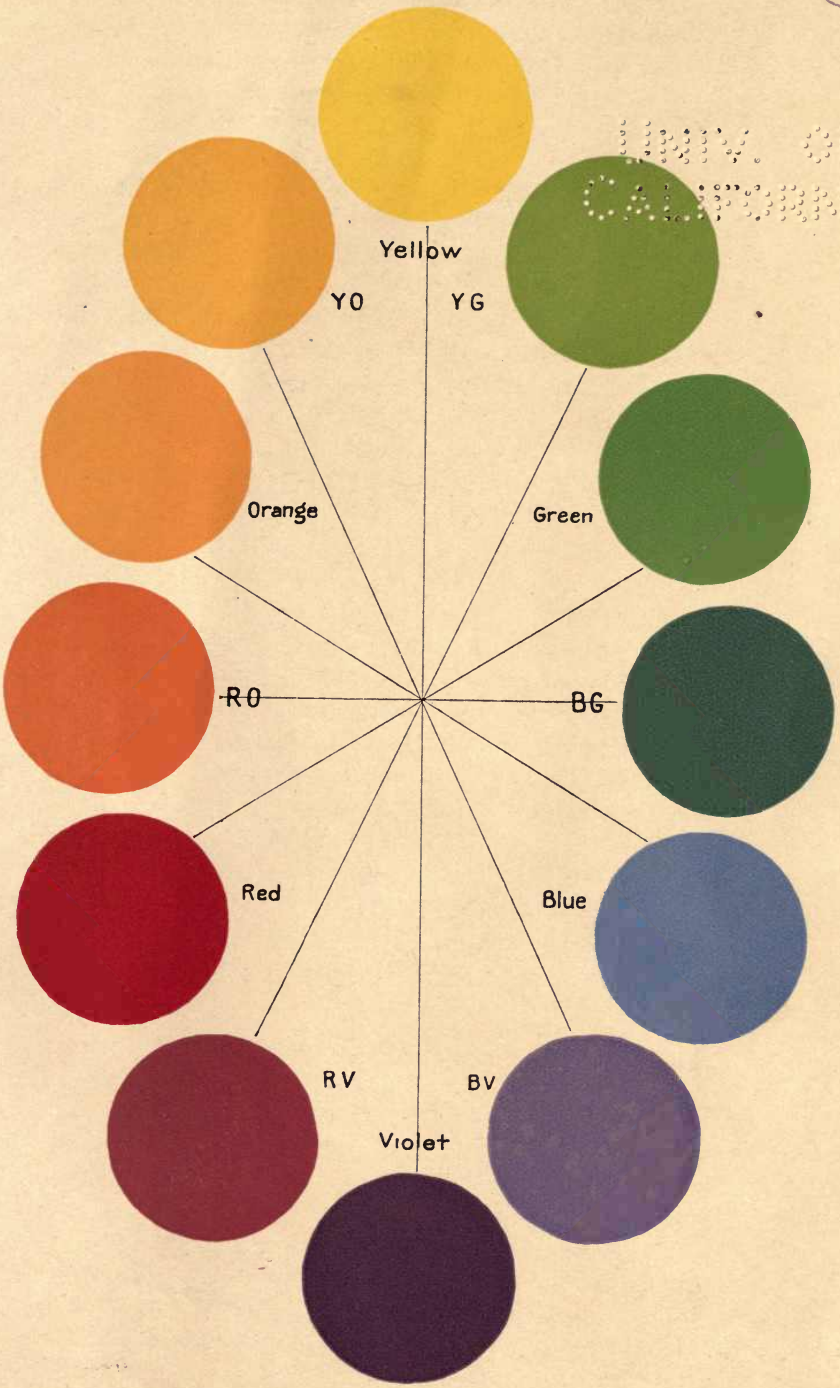


Plate III. Color Chart.

Exception to Rule 2: No. 5 is inharmonious with No. 4.

It will be noticed that these colors depend for their harmony on their order or sequence and their quantity (in this case equal parts of all three). No. 3 being a neutral color, great quantities of it may be used with any other colors. There is danger, however, in getting too much of one of the other two colors. No. 4 is a very strong color and a little will be pleasing while much will be offensive. It is not well to use it alone on a ground of No. 3. No. 5 may be used alone with a ground of No. 3; No. 1 with a ground of No. 3; No. 2 with a ground of No. 3; No. 3 with a ground of No. 2; Nos. 1 and 3 on a ground of No. 2, with a very small quantity of No. 1; equal proportions of Nos. 1 and 4 may be combined on a ground of No. 3; Nos. 2 and 4 on a ground of No. 3, a *very* small quantity of No. 4 being used.

TANAY SABUTAN COLORS (MOSTLY VEGETABLE).

1—Black.
2—Blue-green.
3—Natural.
4—Yellow.
5—Red-orange.
6—Red-orange red.

It will be necessary to use No. 3 on a ground work. Mats made entirely of any of the other colors would hardly be harmonious on a floor or wall, if there were any other furnishings. Nos. 1, 2, 5 and 6 may be used separately upon a ground of No. 3; No. 2 in large quantity; No. 1 in small ground of No. 3; No. 2 in equal quantity with No. 5 upon a ground of No. 3; No. 5 in equal quantity with No. 6 upon a ground of No. 3; No. 6 in large quantity, with No. 2 in small quantity, upon a ground of No. 3; No. 5 in large quantity, with No. 1 small, on a ground of No. 3.

STRIPPING MAT STRAWS.

Philippine mat straws can be divided into three classes—palm straws, pandan straws, and straws obtained from sedges. The first two are obtained by stripping the leaves of the plants into narrow lengths. For this purpose there is used in most localities a small gauge held between the thumb and index fingers. A knife blade fitting in the notches serves as the cutting edge. The leaf is held in one hand and the gauge and knife in the other, the edge of the leaf being drawn through the gauge. This is generally made out of the stiff part of the leaf, though,

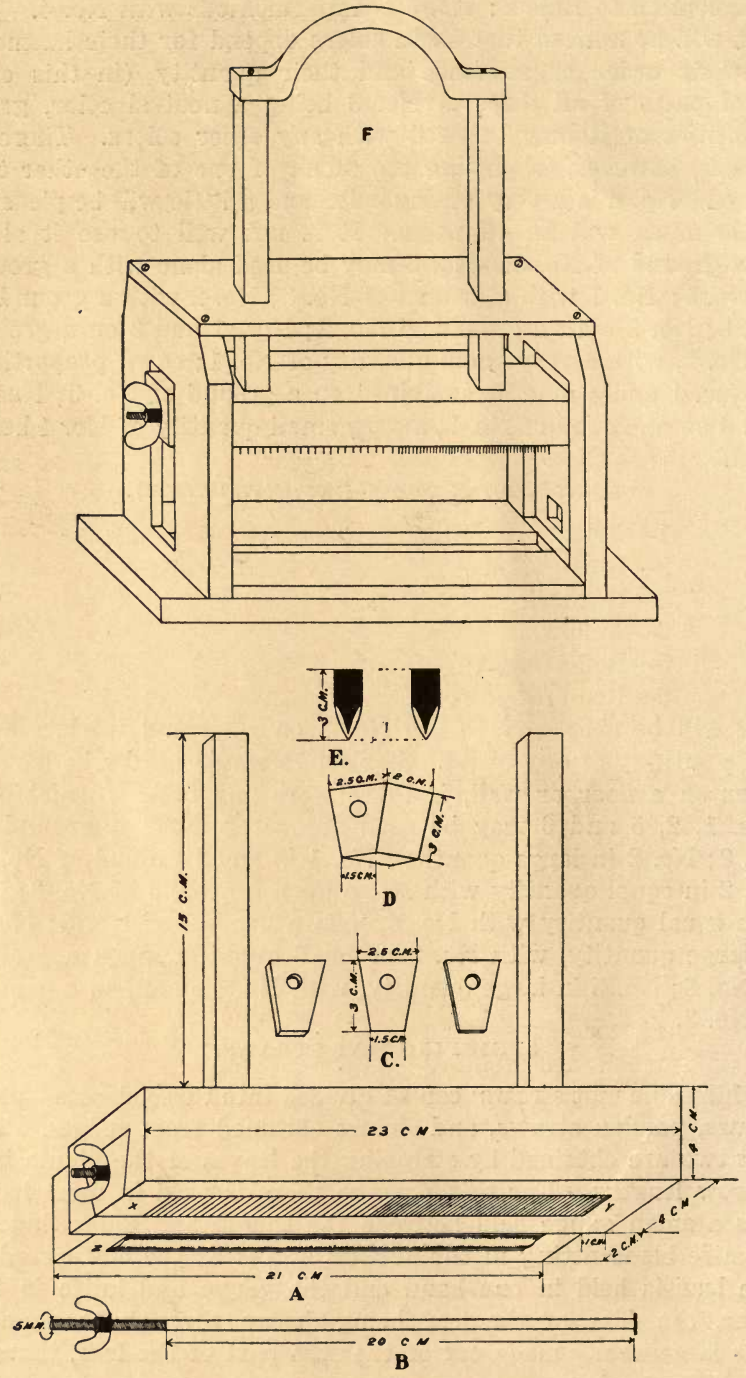

F
3 C.M.
E.
2.5 C.M.
2 C.M.
3 C.M.
1.5 C.M.
D
15 C.M.
2.5 C.M.
3 C.M.
1.5 C.M.
C.
23 C M
4 C M
X
Y
Z
1 C.M.
2 C.M.
6 C M
21 C M
A
5 M.M.
20 C M
B

Plate IV.

occasionally, of a piece of rattan, bamboo or leather. At best it serves for only a few hours of use, when it is thrown away and another made.

When the notch becomes worn, the blade moves about in the gauge, causing the width of the straws to vary, and when a new gauge is made there is always more or less variance in the position of the new notches. This method is very slow, as but one strip can be cut at a time; and, until the operator becomes expert in the use of the gauge, many of the strips are worthless. When used in the school room, each pupil has to prepare his own material. This causes waste of materials and a constant littering of the floor.

Plate V. Stripping with a gauge.

For stripping sabutan leaves, the mat weavers of Tanay, Rizal, use a kind of comb which is discussed under the heading "Sabutan." The leaves are pulled over this comb before being dried. As sabutan is parallel veined it is very easy to strip it thus, the teeth of the comb following the leaf fibers. The comb produces several uniform straws with one stroke.

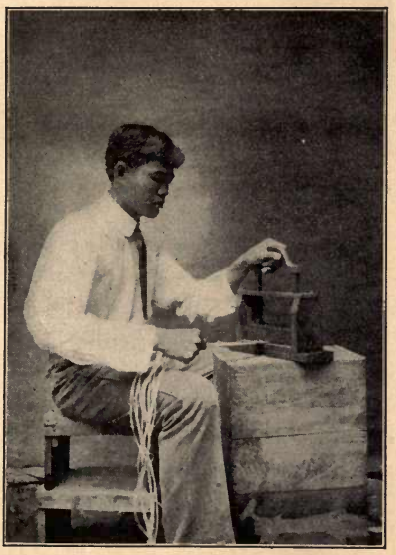


Plate VI. Stripping buri straw with the Andes stripper.

The object of contriving the stripping machine illustrated and described here was to furnish a quick means of preparing palm and pandan straws with uniform widths and clean cut edges. Forms of it have been in use for some time and the model noted here has been tried out for a year. By its use one pupil can prepare materials for the whole class, or else the

teacher can have all the materials prepared beforehand if it is so desired. This is half the problem of teaching the weaving of hats or mats.

This stripper is made wide enough for inserting teeth three widths apart, so that without adjusting these teeth three widths of straw may be cut. By changing the teeth in the adjustable gums, any width desired may be obtained.

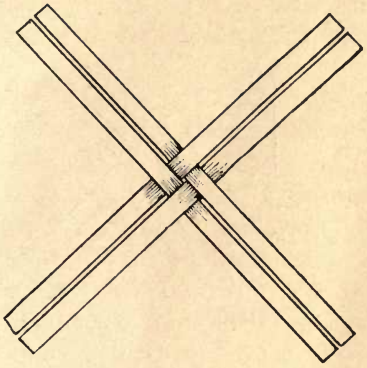
It is best to make this apparatus of hard wood, especially the piece represented by Fig. A. A is a block of wood 23 cm. by 4 cm. by 4 cm., containing the groove XY. This groove is the size and shape of C, being 2.5 cm. wide at the top, 1.5 cm. at the bottom, and 3 cm. high. C is one of the blocks which slides in the groove XY. These blocks are made of different thicknesses, about 2, 3, and 4 mm., and are of hard wood or metal. The rod B passes through these blocks and tightens on the block D or X by means of a thumb screw. Z is a wooden roller 19 cm. long and 1.5 cm. in diameter. This should extend 2 mm. below the level of the main surface. It is placed in a groove made in a separate piece of wood from the principal block and is fastened into the principal block by means of screws.

The teeth (see C) are made of clock springs or other thin sharp metal. They are 3 cm. long and 1 cm. to $1\frac{1}{2}$ cm. wide. The two upright pieces at both ends contain grooves on the inside in which the block-head slides up and down.

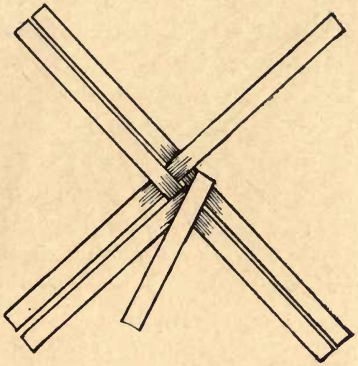
To operate this device, the block-head containing the teeth is raised by the handle; the leaf is placed under the teeth, and the block-head is dropped. The teeth pass through the leaf into a groove underneath. The leaf is now pulled through by the hand as illustrated in Plate VI.

KINDS OF WEAVES.

With respect to their weaving, Philippine mats divide themselves into six groups and are here arranged according to their difficulty. They are (1) the over and under weave found in most simple mats, such as those made of buri straws, pandan straws, and sedges; (2) the sawali weaves, which employ the floating straws for making "woven in" designs and panels for figured sabutan and tikug mats; (3) the open work weaves of the Romblon buri mats; (4) the circular mats which employ the hat weaves, either with or without "woven in" designs; (5) the hexagonal weave; and (6) the embroidered mats in which the designs are later added. In difficulty, and in place in a course of instruction, embroidered mats follow the simple over and under weave.



Step 1.



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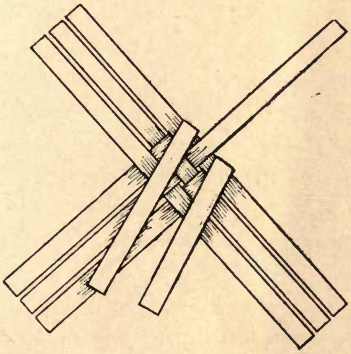

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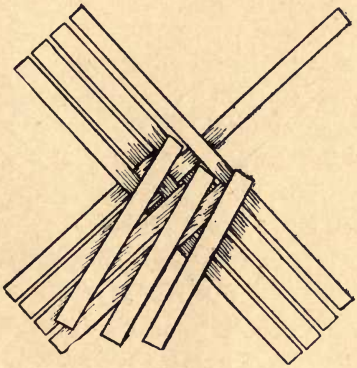

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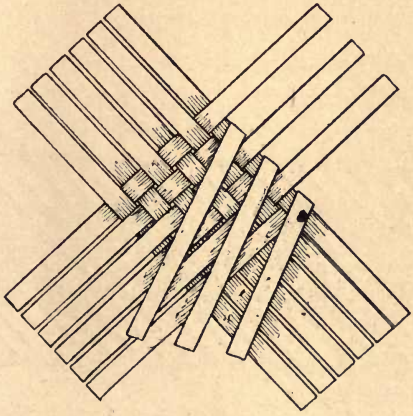
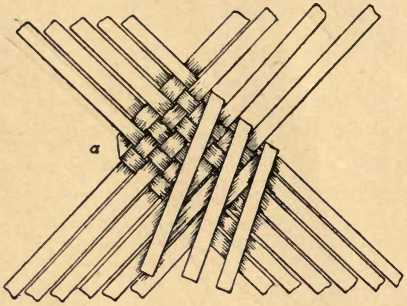


Step 5.

Plate VII.



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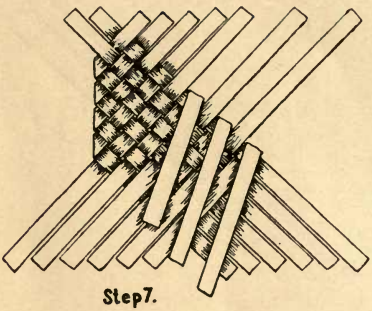

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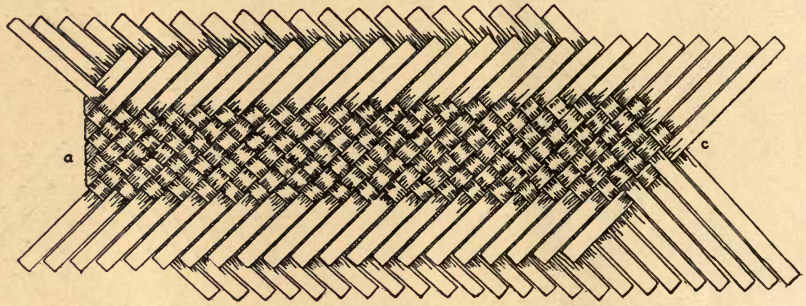

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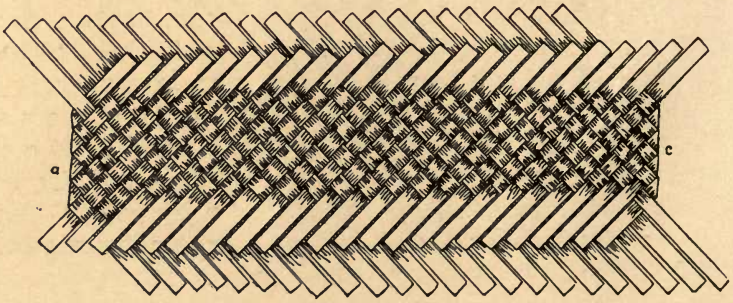
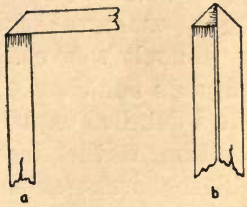


Step 9.

Plate VIII.



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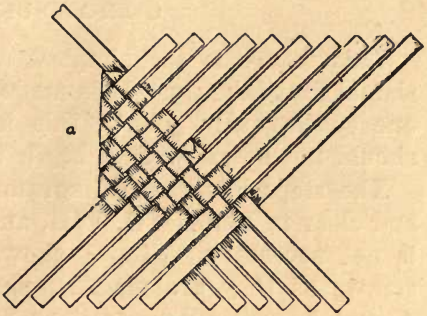

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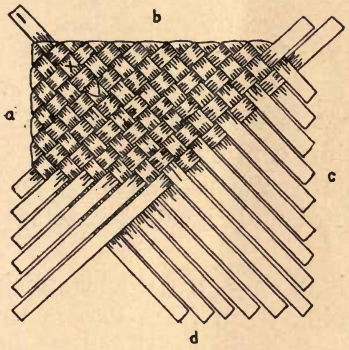

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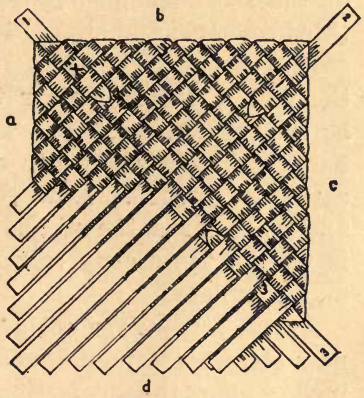
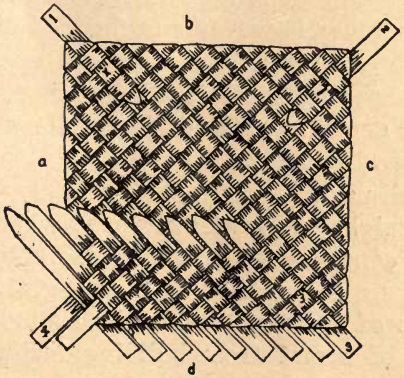


Step 13.



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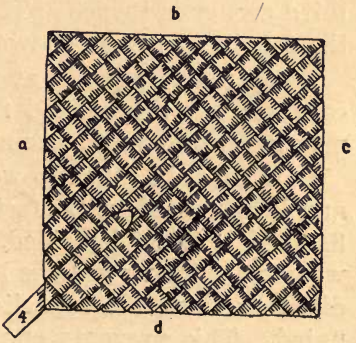


Step 15.

Plate IX.

OVER-AND-UNDER WEAVE.

This weave is the simplest and is the one which beginners should first take up. It is made by weaving over one and under one continuously. Until this is thoroughly mastered children should not be allowed to begin the more difficult weaves.

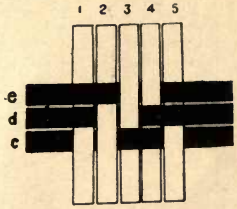
The steps have been diagrammed in figures sufficiently large and clear in Plates VII, VIII, and IX that a detailed explanation is not necessary. Step 1 shows the position of the first four straws as they are placed upon the table or desk; steps 2, 3, 4, and 5, continued additions and weaving; steps 6, 7, and 8, turning the edge *a* on the end of the mat; step 9, turning the opposite edge *c*; step 10, the double turn of the corner straw; step 11, the corner turn woven in the mat at corner No. 1, lapping over the straw already woven; step 12, the continuation of the second edge *b*; step 13, the turning of the second and third corners; and steps 14 and 15, finishing the mat.

In weaving large mats, it is customary to begin at one end of the mat, preferably near the left-hand corner as the mat lies before the weaver. The weaving continues along the end until half of the desired width of the mat is reached, when the first corner is turned. Now the weaving continues down the side and in, as far as the middle of the mat. When the desired length is woven, the second corner is turned and the first half of the mat completed.

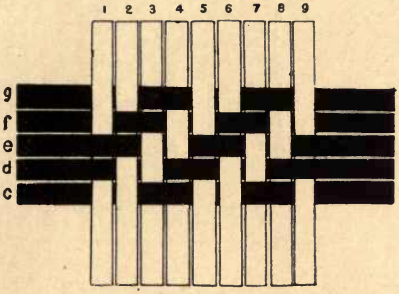
As the straws are not generally long enough without splicing, new straws are now added by lapping them from two to three inches upon the projecting ends of the straws already woven. This makes a narrow strip of double thickness down the center running the length of the mat. The weaving now continues as before until the desired width of the mat is attained, when the third corner is turned. The remainder is woven and finished at the fourth corner as shown by steps 14 and 15.

Some weavers begin at the sides, and some few, even at the corners; but this should not be encouraged since it results in making two or more seams, where the straws lap.

Care must be taken to weave all parts of the mat equally close and keep the edges perfectly straight; otherwise the mat when finished will be lop-sided, and consequently of no value. In weaving tapering grasses like tikug, which have ends of slightly different sizes, the opposite ends of the straws should be alternated. This prevents one edge of a mat from building faster than the other.



Step 1.



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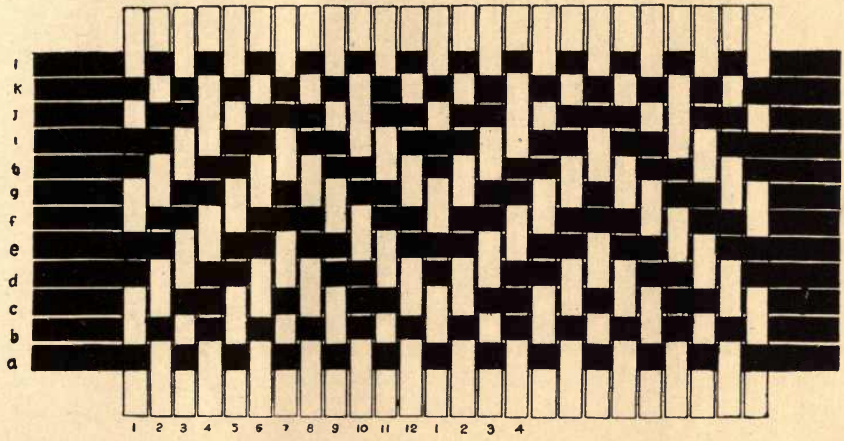

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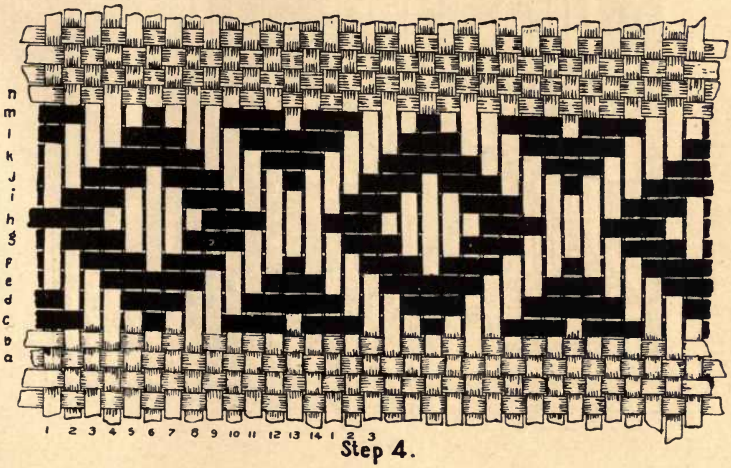
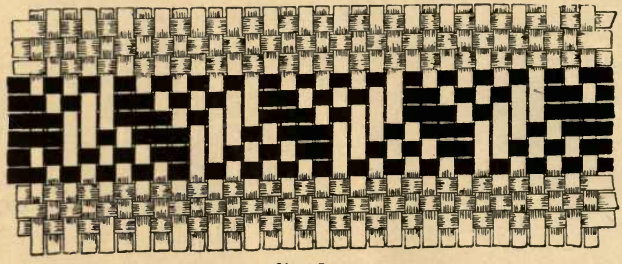
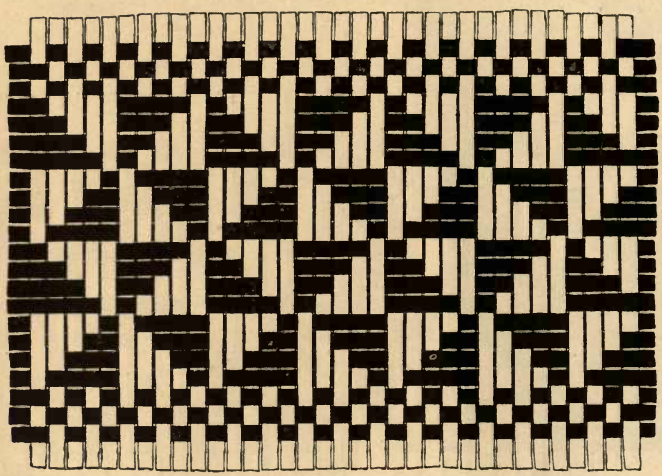


Step 4.

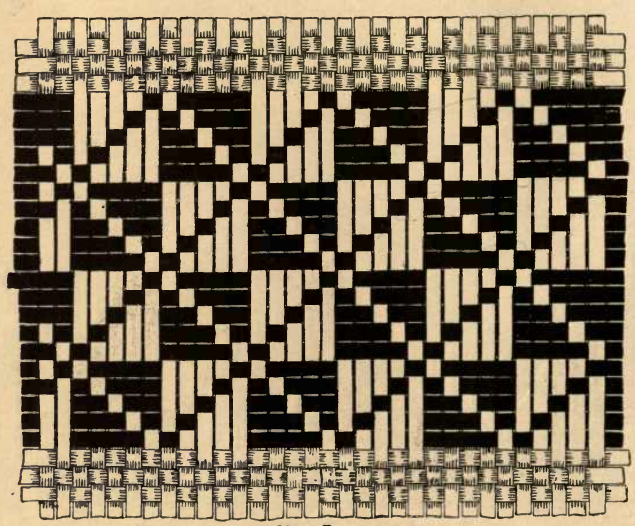
Plate X.



Step 5.



Step 6.



Step 7.

Plate XI.

SAWALI WEAVES.

SIMPLE SAWALI.

By sawali weave is meant all "woven in" designs that are not woven by *ones* as in the over and under weave. They may be woven regularly by *twos, threes,* etc.; or they may "switch" the floating straws so as to form a variety of artistic figure designs. In fact, there is no limit to the number of designs that may be thus made.

Steps 1 and 2 illustrate the beginning of a sawali weave by *twos.* First 1, 2, 3, 4, 5 are laid down; then *c* is put under 1–2, over 3–4, and under 5; *d* over 1, under 2–3, and over 4–5; *e* over 1–2, under 3–4, and over 5. This process is continued, advancing one straw each time until the desired amount is woven. If the weaving is by *threes* or *fours,* the same principle is followed; that is, the straw goes over three and under three, advancing one straw each time.

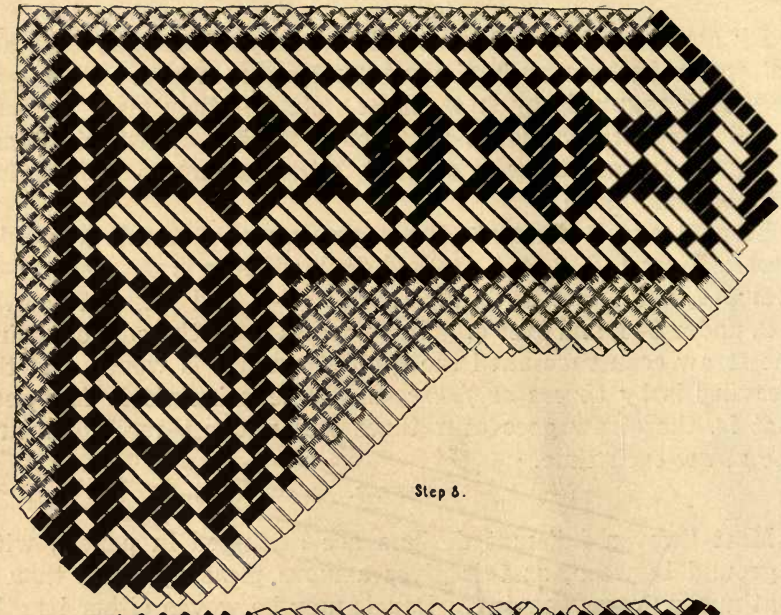
PANELS.

Most "woven in" mat designs are arranged in panels, with a ground between, as this gives a more pleasing effect than a continuous figure weaving. Panels may be woven either lengthwise (step 8), crosswise (step 8), diagonally across the mat (step 4), or in zigzags (step 3). They are most easily woven when arranged diagonally, for then the colors may be carried from border to border without mixing with the ground outside of the panel. Checks are made by weaving cross panels at regular intervals.

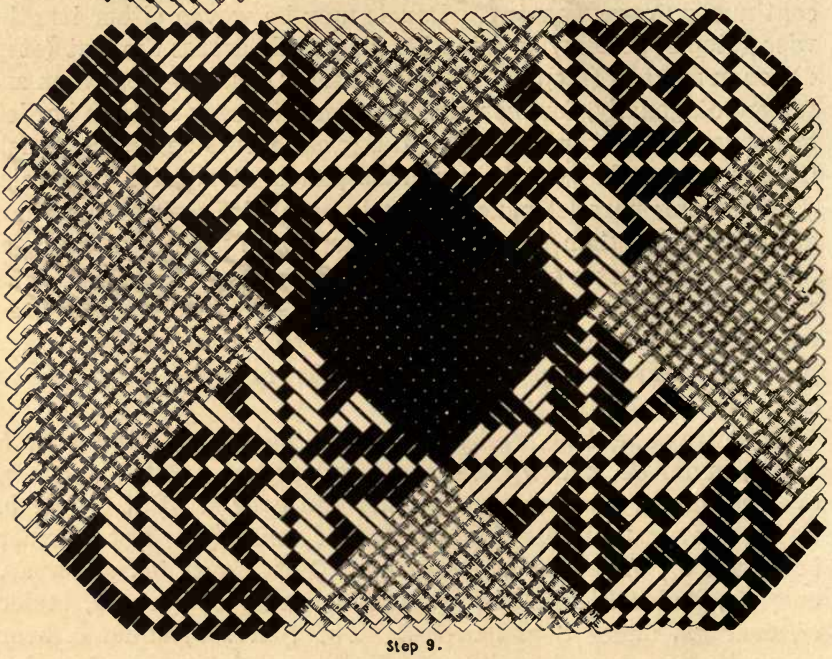
In making parallel panels (panels parallel either to the sides or ends), more than two colors can rarely be used to advantage.

Step 3 illustrates the weaving of a zigzag sawali panel. The straws, *a, b, k,* and *l* are woven by *ones.* It takes twelve straws one way and nine the other to make this panel. If a wider panel is desired, the same weaving is repeated as often as necessary.

The straws *a, b, k,* and *l* are woven by *ones.* Put *l* over *b* and *c,* under *de,* over *fg,* under *hi* and over *j.* Put 2 under *b,* over *cd,* under *ef,* over *gh,* under *ij* and over *k.* Put 3 over *b,* under *c,* over *de,* under *fg,* over *hi* and under *jk.* Put 4 under *bcd,* over *ef,* under *gh* and over *ijk.* Put 5 over *bc,* under *de,* over *fg,* under *hi* and over *j.* Put 6 under *b,* over *cd,* under *ef,* over *gh,* under *ij* and over *k.* Put 7 over *b,* under *c,* over *de,* under *fg,* over *hi,* under *jk.* Put 8 under *b,* over *cd,* under *ef,* over *gh,* under *ij* and over *k.* Put 9 over *bc,* under *de,* over



Step 8.



Step 9.

Plate XII.

fg, under *hi* and over *j*. Put 10 under *bcd*, over *ef*, under *gh* and over *ijk*. Put 11 over *b*, under *c*, over *de*, under *fg*, over *hi* and under *jk*. Put 12 under *b*, over *cd*, under *ef*, over *gh*, under *ij* and over *k*. Then the whole operation is again repeated. It will be seen that the manner of weaving 2 and 12, 3 and 11, 4 and 10, and 5 and 9 is the same.

Step 4 illustrates the diamond figure design, woven by threes, with 11 straws in width.

Put 1 under *cd*, over *efg*, under *h*, over *ijk* and under *lm*. Put 2 under *c*, over *def*, under *ghi*, over *jkl* and under *m*. Put 3 over *cde*, under *fghij* and over *klm*. Put 4 over *cd*,

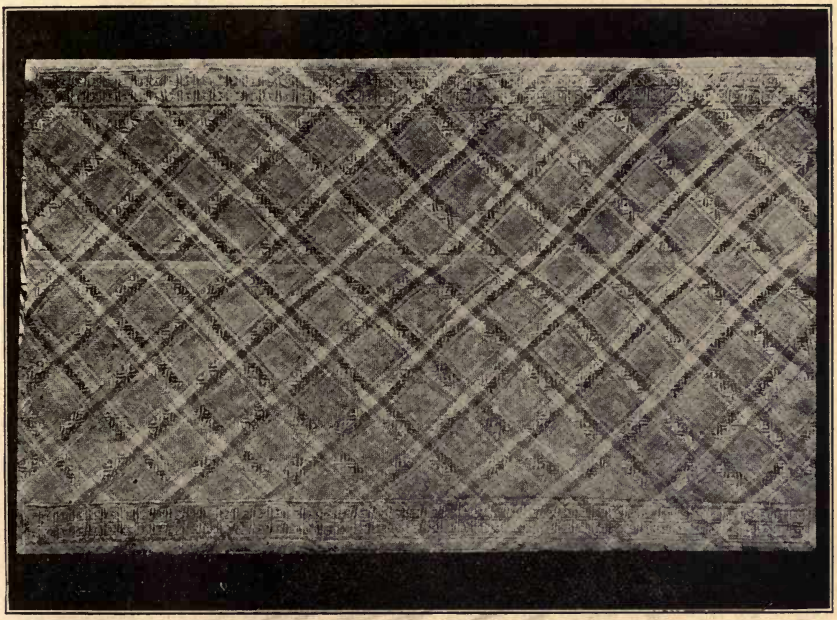


Plate XIII, fig. 1. Mat with woven-in border showing confusion in design.

under *efg*, over *h*, under *ijk* and over *lm*. Put 5 over *c*, under *def*, over *ghi*, under *jkl* and over *m*. Put 6 under *cde*, over *fghij* and under *klm*. Now the order reverses, 7 being the same as 5, 8 as 4, etc., until the other half of the figure is completed at 11. Now put 12 under *cde*, over *fghij* and under *klm*. Put 13 over *c*, under *def*, over *ghi*, under *jkl* and over *m*. Put 14 under *cde*, over *fghij* and under *klm*. Now 1 repeats itself, and the second figure is woven as the first. It is believed that with the aid of the large illustrations here presented the teacher or pupil can now follow for himself the other designs given, without a detailed explanation of each step.

"WOVEN-IN" BORDERS.

Woven-in border designs may be made in three different ways; viz., *First*, by weaving the design around the mat, using the same straws that run through the body. (See Plate XIII, Fig. 1.) In this case the color effect is one of confusion, since the dyed straws used in the designs of the body of the mat have no relation to the design of the border when they enter it. *Second*, by weaving the border and the body of the mat of different straws, uniting them at the inner edge of the border by a loop as described in the Romblon mat. (See Plate XVI.) *Third*, by lapping the colored straws desired in the border, upon the projecting ends of the straws of the body of the mat. (See

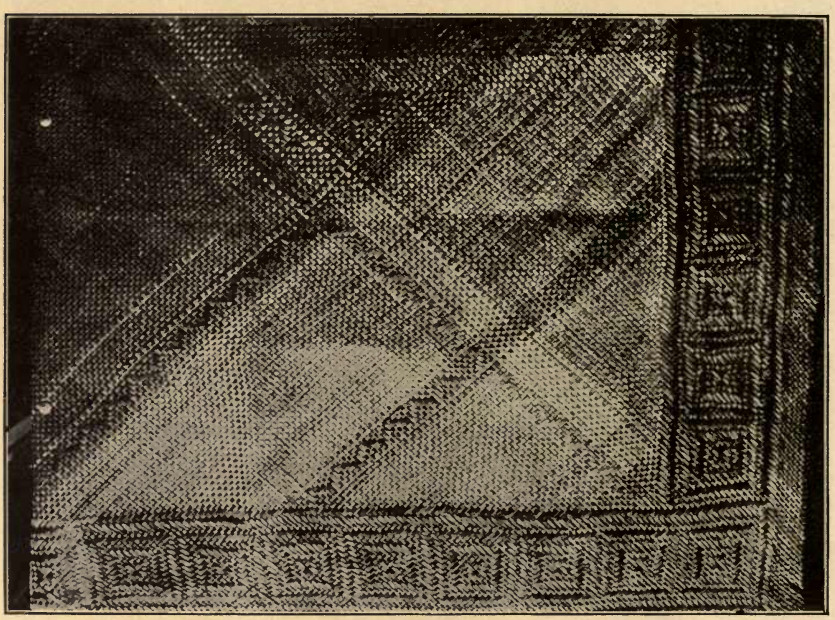


Plate XIII, fig. 2. Mat with woven-in design made by lapping straws.

step 8, Plate XII.) These latter two methods are much more artistic, as a uniform color effect appears throughout the border. (See Plate XIII, Fig. 2.)

THE ROMBLON MAT.

MAKING OPEN WORK.

Simple open work is illustrated in Plate XIV.

Weave corner Z, using straws *a*, *b*, *c*, *d*, *e* and *f*, letting *f* float at both ends. Weave *g*, turning upward and over *f*, then making a double corner at *y*, passing under *f*, to the left and over *f*, and

let float. Weave *h*, *i*, *j*, *k*, *l* and *m* in solid weave. Turn *h* under *i* and over *j*. Turn *j* upward and over *i*, to the left under *f*, upward over *g*, double corner at W, passing down under *g*, over *g*, and floating. Turn *m* upward over *l* to the left, under *i*, upward over *f*, to the left under *g*, upward over *j* making a double corner at X, passing under *j*. The straws *j* and *m* alternately cross each other to corner V.

The other half of this open design is an exact duplicate of this weaving, and the remaining designs have the same turns as the one explained, except that in opposite designs the straws

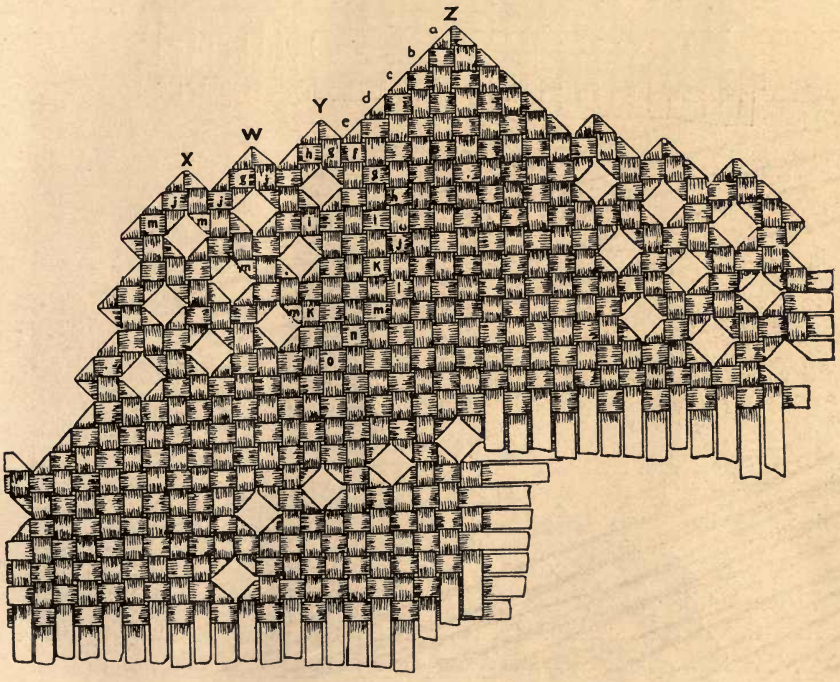


Plate XIV.

are turned in opposite directions. By following this plate it is easy to finish the weaves. If one straw is woven over another, it folds down before passing over, and, vice versa, if it passes under, it folds upward in turning.

As is seen, the holes are made simply by turning the straws in the weave. The different shaped holes in other designs (see plates) are made by turning a different number of straws according to the shape desired. Varied border edges may be made by switching the straws in any direction desired.

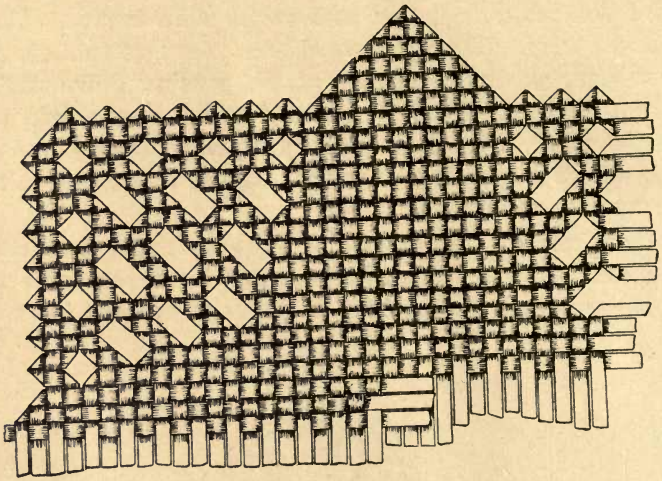


Fig. 1.

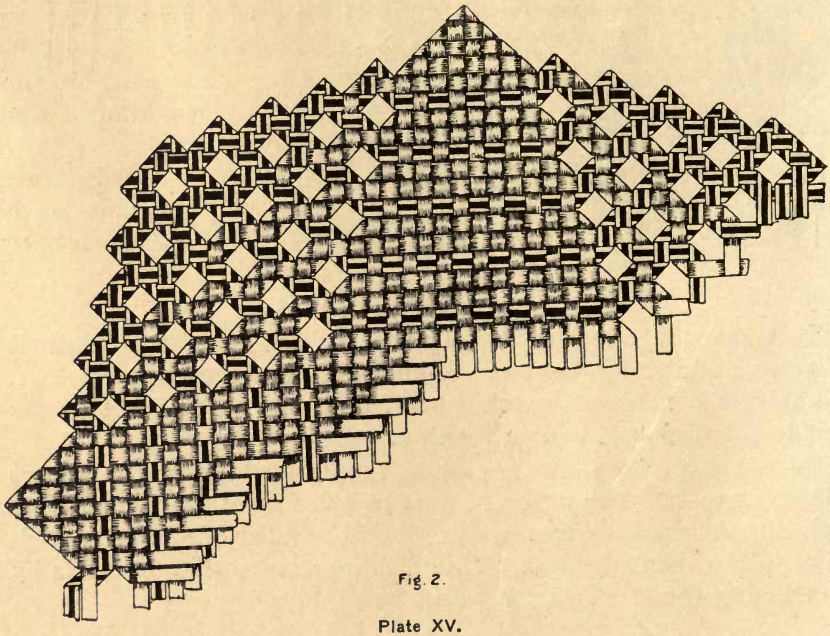


Fig. 2.

Plate XV.

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INTRODUCING COLOR PANEL.

Step 1 of Plate XVI shows the first colored panel, straw *ab* placed between *cd*, the space between *x* and *y* having been already woven, as shown in step 11.

Step 2. Folding *a* to the right.

Step 3. Folding *a* under and down.

Step 4. Folding *c* over *a* and to left.

Step 5. Folding *a* over *c* and upward.

Step 6. Folding *b* under *d* to left.

Step 7. Folding *b* upward, with right twist downward.

Step 8. Folding *d* downward, with right twist to right.

Step 9. Folding *b* under *d* upward.

Step 10. Shows addition of second straw *ef* woven to the right, where the same process of turning is gone through as illustrated in steps 6 to 9 inclusive. If weaving is to the left, steps 1 to 5 inclusive are repeated.

Step 11. Shows continued additions and weaving both to the right and left.

Step 12. Shows both edges of panel woven, the inside turnings being the same as those of the outer edge.

CIRCULAR MATS.

The circular mat is woven like the crown of a hat, with either the radiating center or a square center radiating at the four corners. In either case, the weaver must be careful to add the proper number of straws so that the mat will be flat, and not cupped or fluted. The cupping is caused by not adding a sufficient number and the fluting by adding too many.

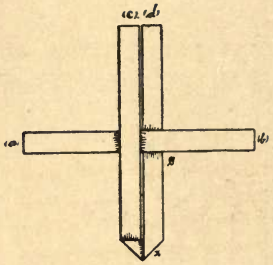
In tightening the weaving, do not pull the added straws (Plate XIX, step 6, straw x–x) or holes will be made at the elbow. Instead, pull the longer straws that run through the center, thus making the entire weaving tight.

RADIATING CENTER.

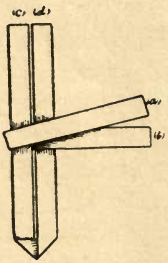
Step 1. Begin by laying down, in pairs, *ab* and *cd* perpendicular to the body. Put *kl* under *ab* and over *cd*. Put *ij* over *ab* and under *cd*.

Step 2. Now put *ef* under *cd* and *ij*, and over *ab* and *kl;* then put *gh* over *cd* and *ij*, and under *kl* and *ab*. See that the two ends of all the straws are equidistant from the center crossing.

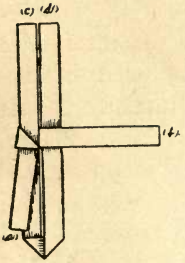
In step 3 the straws are changed from pairs to singles as follows: Bring *a* over *i; e* over *d; i* over *h; d* over *l; h* over *a;* and *l* over *e*.



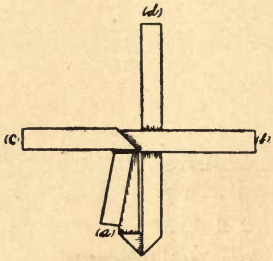
Step. 1



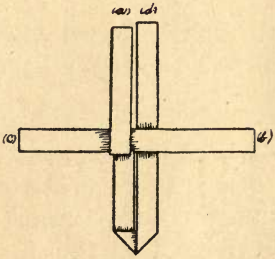
Step. 2



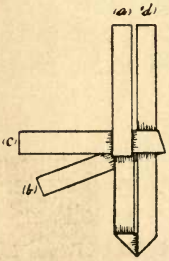
Step. 3



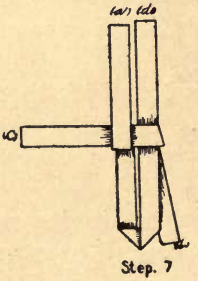
Step. 4



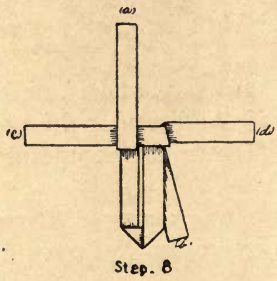
Step. 5



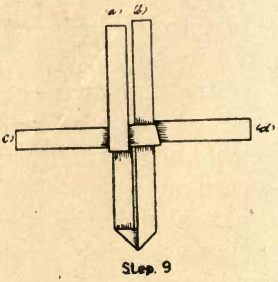
Step. 6



Step. 7



Step. 8



Step. 9

Plate XVI.

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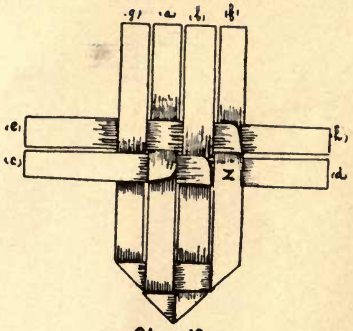
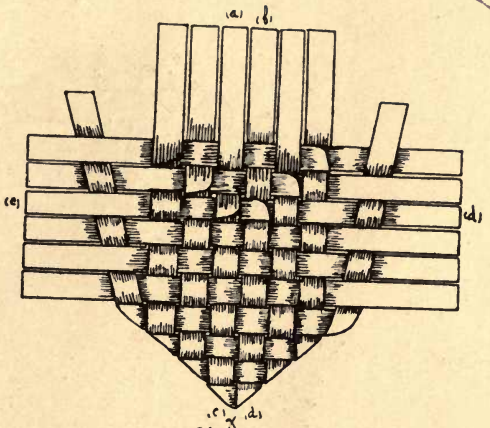
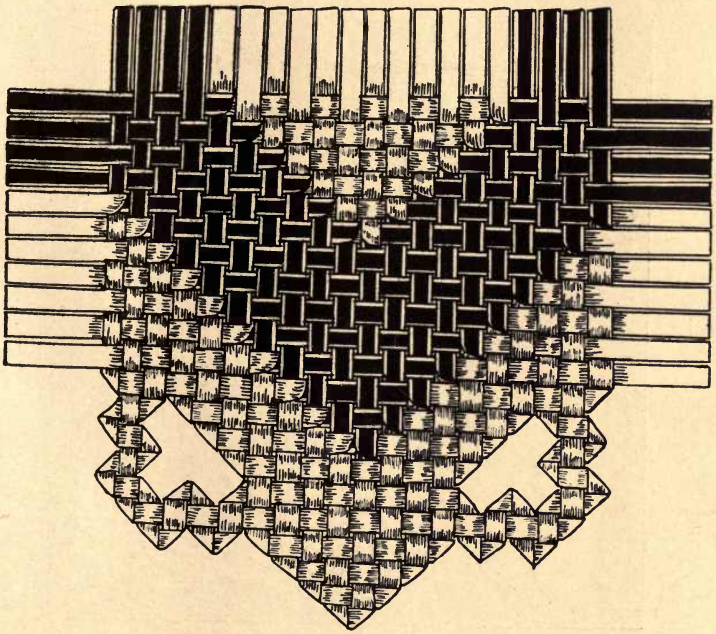


Step. 10



Step. 11



Step 12.

Plate XVII.

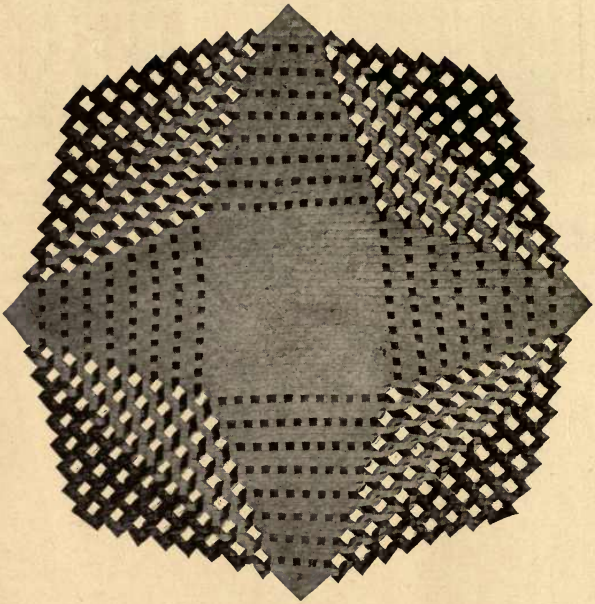


Fig. 1.

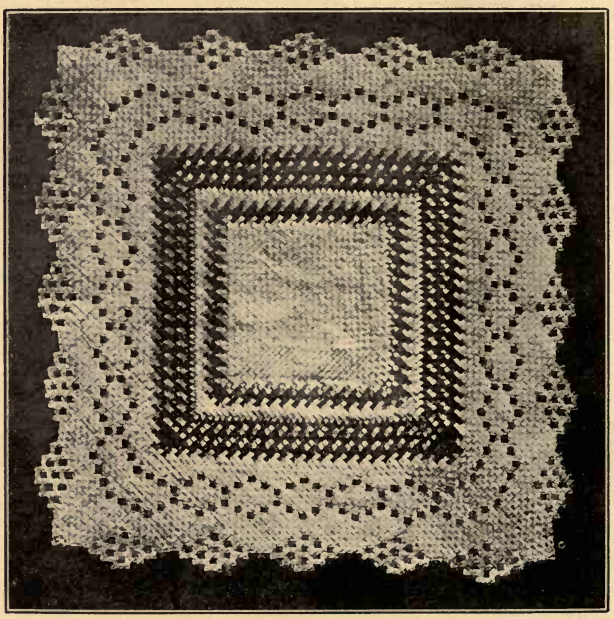
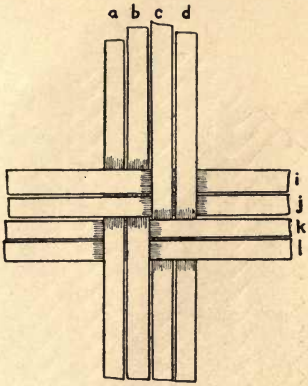
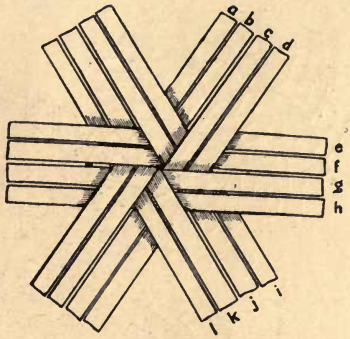


Fig. 2.

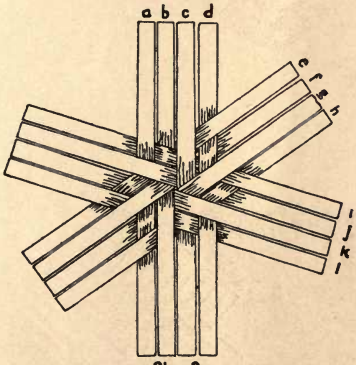
Plate XVIII. Romblon mat designs showing simple open weaves.



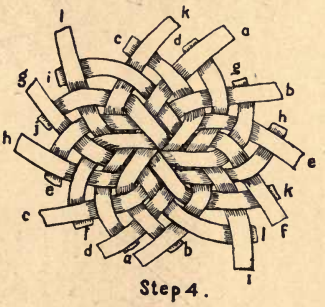
Step 1.



Step 2.



Step 3.



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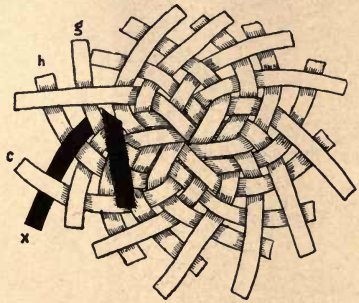
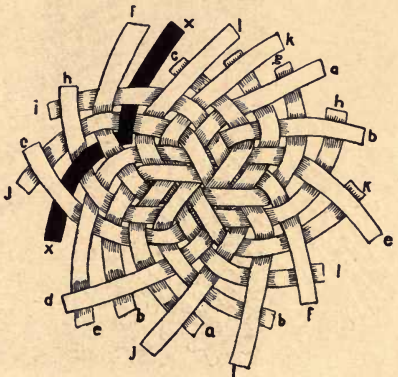
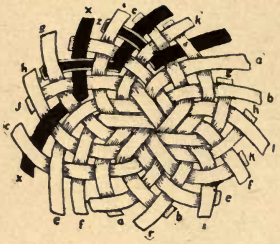


Step 5.



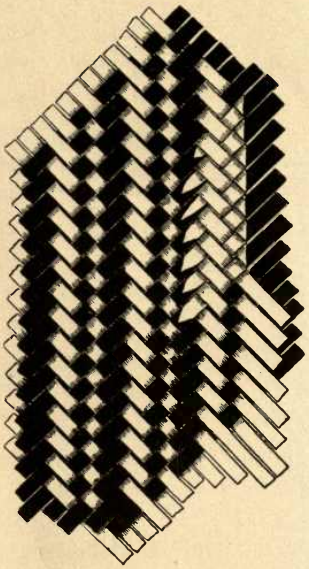
Step 6.

Plate XIX.



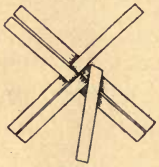
Step 7.

Step 8.

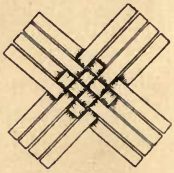


Step 9.

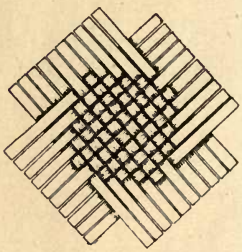
Plate XX.



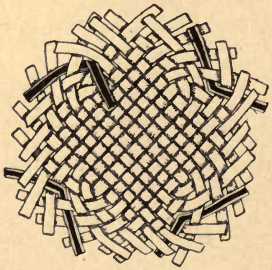
Step 1.



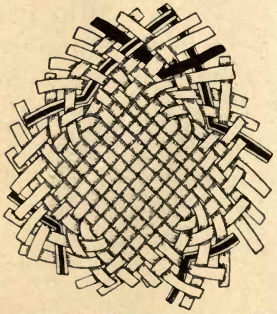
Step 2.



Step 3.



Step 4.



Step 5.

Plate XXI.

Step 4. The most convenient way to perform the next process is to take all the bottom straws in the left hand and allow the top straws to float over the closed fist. Then the weaving is done with the right hand. However, for beginners the weaving may also be done on the table.

In weaving, place *c* under *b*, over *a* and under *k*; *d* over *b* and under *a*; *g* under *f*, over *e* and under *b*; *h* over *f* and under *e*; *k* under *j*, over *i* and under *f*; *l* over *j* and under *i*; *b* under *c*, over *d* and under *a*; *a* over *c* and under *d*; *f* under *g*, over *h* and under *c*; *e* over *g* and under *h*; *j* under *k*, over *l* and under *g*; *i* over *k* and under *l*; the round is then finished.

Step 5. This illustrates the manner of adding straws. Straw *x* is placed under *c*, over *h*, under *g* and then bent back. The bend should be in the middle of the straw.

Step 6. In this the right end of the added straw *x* is brought down over *j* and under *i*.

Step 7 shows how to continue the additions by weaving one straw and then adding one.

Step 8 shows the mat after the first round of additions has been completed. The weaving is now easy. Weave entirely around again without any additions, turning five straws each time. Then go around again weaving two and adding one, in the same manner as before, turning seven straws each time. As the diameter of the mat increases, the less often is it necessary to add. But be sure to add enough to keep the weaving close and the mat perfectly flat.

Step 9 shows how to close the edge of the mat by turning back the straws on each other. It also gives a very pretty "woven in" design for a border, which can easily be followed from the plate.

SQUARE CENTER.

Steps for commencing a circular mat with a square beginning are illustrated in Plate XXI. The additions at the corner are made in the same manner as explained in the radiating center, except that each is for a fourth of a circle instead of a complete circle.

DECORATIONS FOR ROUND MATS.

Decorations are often employed in round mats. (See Plates XXII and XXIII.) The most usual are concentric or radiating colored bands of either simple or sawali weaves.

HEXAGONAL WEAVE.

Step 1. In Plate XXIV, place straws 1 and 2 parallel; then put 3 under 2 and over 1; put 4 under 1 and over 2.

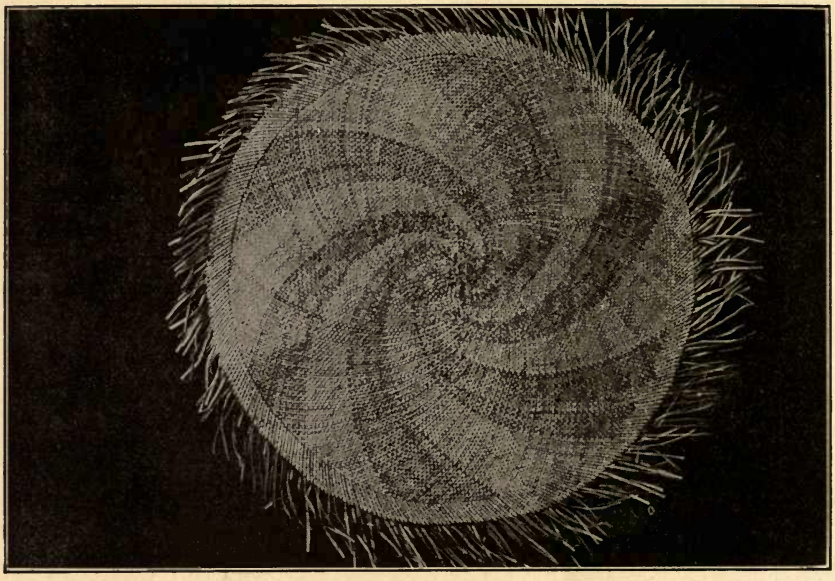


Plate XXII. Circular mat with radiating design.

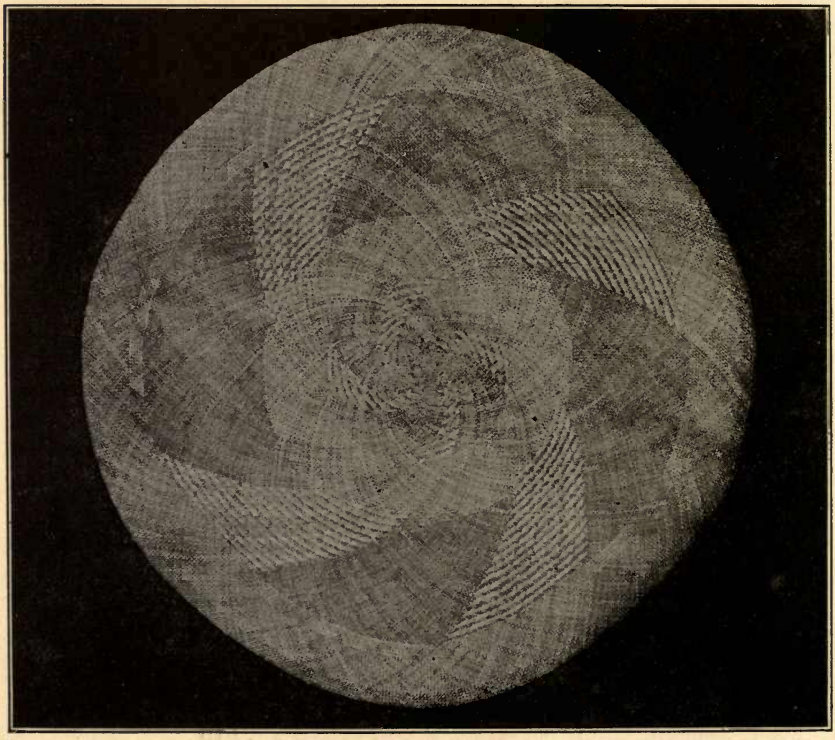
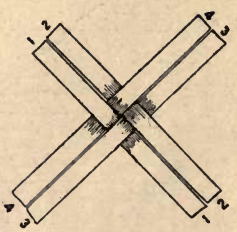
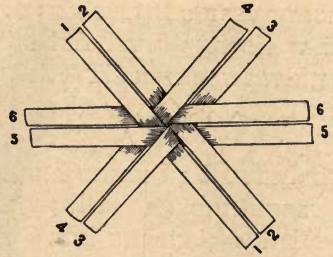


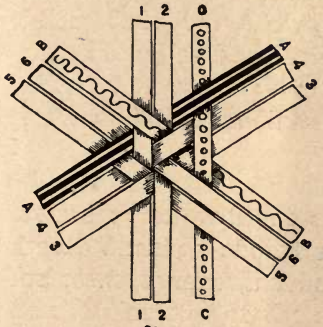
Plate XXIII. Circular mat with concentric and radiating design.



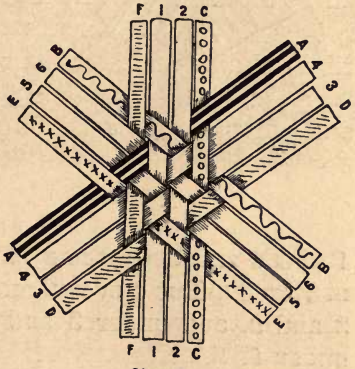
Step 1.



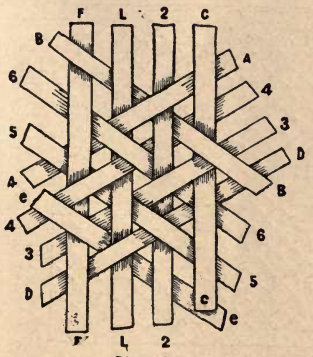
Step 2.



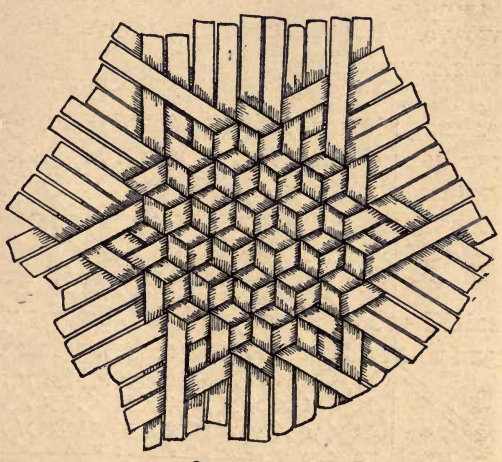
Step 3.



Step 4.

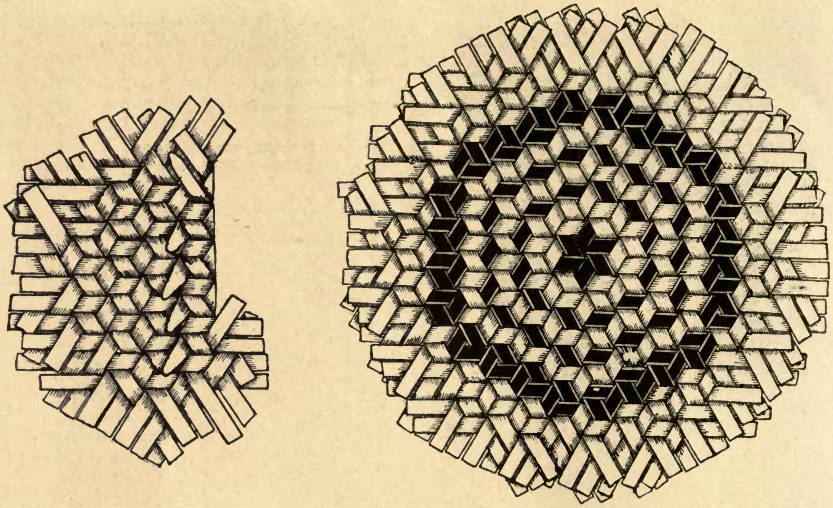


Step 5.



Step 6.

Plate XXIV.



Step 7. Step 8.

Plate XXV.

Step 2. Put 5 over 1 and 4 and under 2 and 3; put 6 under 1 and 4 and over 2 and 3.

Step 3. Put *a* over 5 and 6 and under 1 and 2. Put *b* over 1, 2 and *a*, and under 3 and 4. Put *c* under *a*, over 4, 3, *b*, and under 6, 5.

Step 4. Put *d* under *b*, over 6, 5, *c*, and under 2, 1, *e*. Put *e* under *c*, over 2, 1, *d*, under 3, 4, and over *a*. Put *f* under *d*, over 3, 4, *e*, under 5, 6, *a*, and over *b*.

Step 5 is made open so as to show the triple over and under weave. Further weaving is merely a repetition of this process, as shown in step 6.

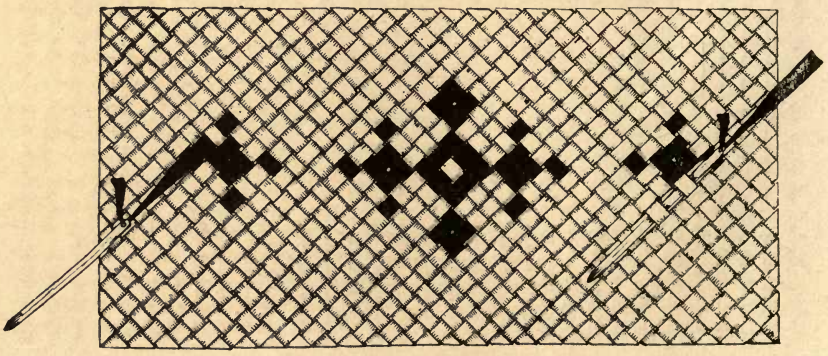
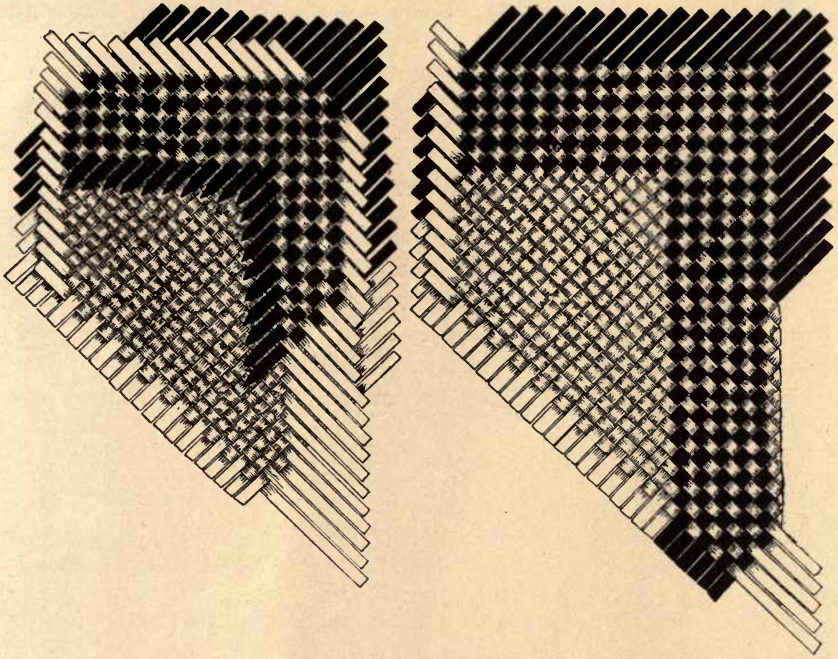


Plate XXVI.



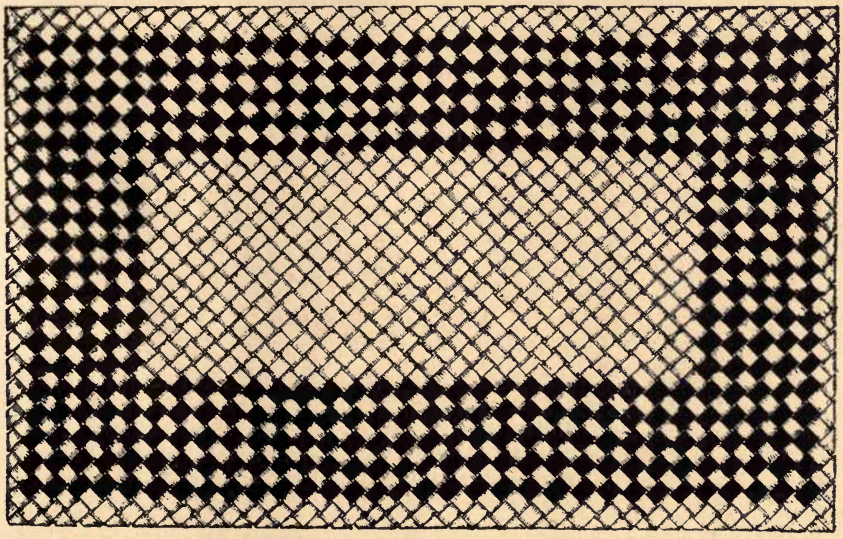


Plate XXVII.

Step 7 shows the turning of the straws on finishing the edge of the mat.

Step 8. Many designs can be made by inserting colored straws into the natural weave. Step 8 illustrates three of these embroidered designs—the star, the bar, and the diamond.

EMBROIDERED MATS.

The embroidering of mats is easily done and the method is shown in Plate XXVI. Mats in over and under weave, of solid color (either natural or dyed), are used, and the embroidery is done with colored straws. Plate XXVII illustrates an embroidered color panel. Floral, geometrical, and conventionalized designs are discussed under the headings "Samar mats" and "Special designs."

MAT MATERIALS.

Many Philippine mat materials have been described in a former publication on hats.[6] Only additional and new information is written here and such data from Bulletin 33 as are necessary to make a connected article.[7]

BURI STRAW.

THE BURI PALM.

There are about six species of the genus *Corypha* in tropical Asia, but only one of these is found in the Philippines; this is *Corypha elata,* the buri palm.[8] It is widely distributed throughout the Philippines but is most abundant in the central part of the Pampanga valley and in southern Tayabas.

Mr. C. W. Franks, formerly Division Superintendent of Schools for Mindoro Province, had a careful estimate made by his teaching force of the stands of buri palms on the Island of Mindoro. It was found that 5,000 hectares of land on this

[6] Bulletin No. 33 of the Bureau of Education, entitled "Philippine Hats."

[7] This office is indebted to Mr. E. D. Merrill, Botanist, Bureau of Science, Manila, P. I., for placing at its disposal an unpublished manuscript on the Flora of Manila. Information from the following sources is also acknowledged:

Engler and Prantl: Das Pflanzenreich.
Hooker's Flora of British India, 1894.
Blanco's Flora de Filipinas, 1877.

The sugar and alcohol produced by the palms are discussed by Dr. H. D. Gibbs in the Journal of Science, Manila, Vol. VI, Sec. A, No. 3. Hats are also discussed by Mr. C. B. Robinson in the same Journal, Vol. VI, Sec. C, No. 2.

[8] Buri (in most localities), buli or búle, silag, ebus.

island are covered by 2,000,000 buri palms, of which 225,000, or about 12 per cent, are mature trees.

The Island of Burias, the Isla Verde, and other small islands are fairly covered with the palm. The Province of Sorsogon, including the Island of Masbate, is also well supplied. In the Visayas there are districts in Panay, Negros, Cebu, and Bohol, where many buri trees are found.

The buri is the largest palm that grows in the Philippines, attaining a height of 20 meters. Its trunk is very erect, spirally ridged and up to 0.7 meter in diameter. Its wood is of no commercial value.

Plate XXVIII. Foliage of the buri palm.

The full-grown leaves may be three meters long. They are spherical in outline and the lower one-third or one-half is entire, like the palm of the hand. The upper part is divided into from 80 to 100 segments each from 1.5 to 6 cm. wide and appearing like fingers spread apart. The petioles supporting the leaves are about 3 meters long and 20 cm. thick, and are provided with long, stout, curved spines. Both margins and spines are black in color. At flowering time all the leaves are shed. The young leaf grows out from the top of the palm with the segments pressed together in the form of a lance.

The buri flowers and fruits but once and then dies. This is said to occur when the plant is from 25 to 40 years old. The individual flowers are greenish-white in color and only from 5 to 6 mm. in diameter. They are nevertheless perfect flowers, with calyx, corolla, and ovary showing plainly a division into threes, and stamens six in number. Thousands of these flowers occur on the large, terminal, much branched, pyramidal inflores-

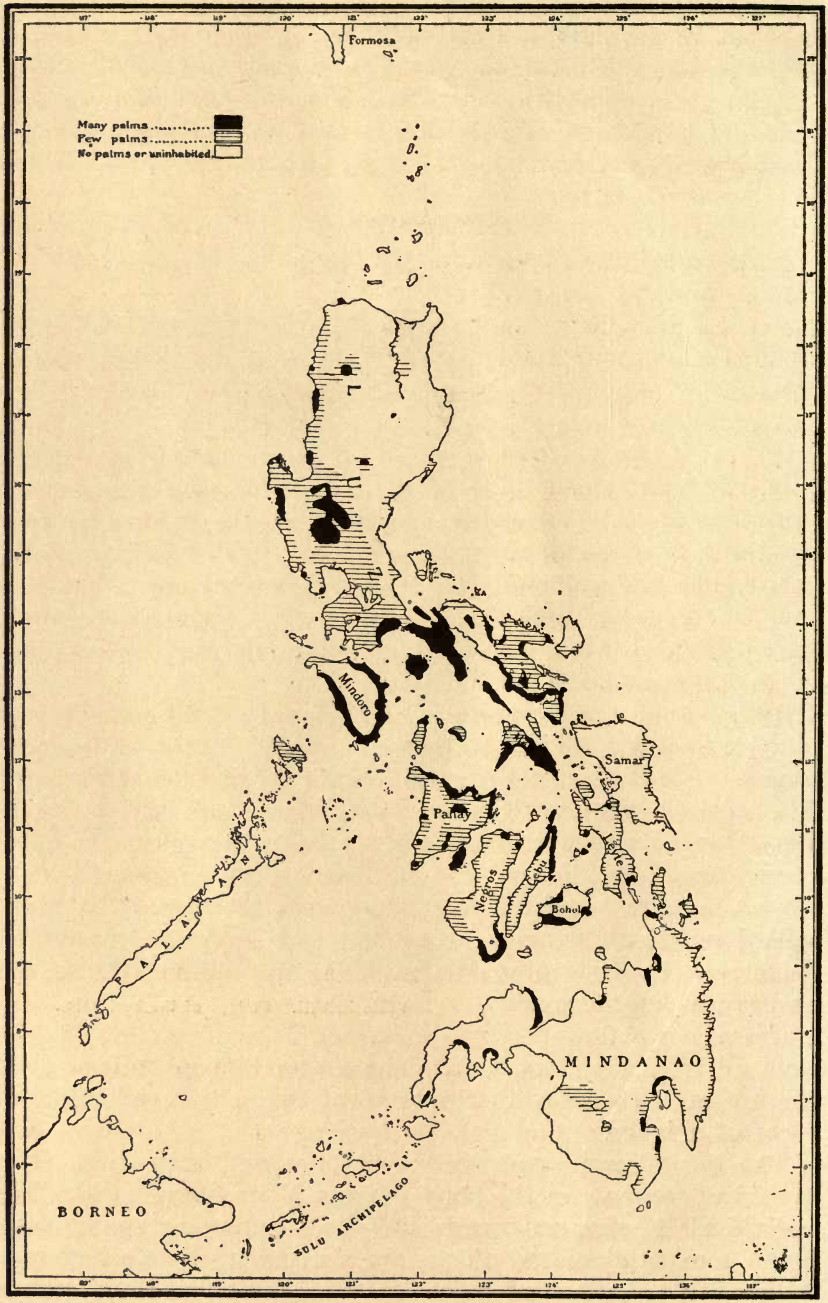


Plate XXIX. Distribution of the Buri Palm.

cence which may grow to be 7 meters in height. The lower branches of this inflorescence may be as much as 3.5 meters long, the upper shorter, the highest about one meter in length.

From 10 to 12 months after flowering the fruits are mature. They are from 2 to 2.5 cm. in diameter and each contains an extremely hard seed 1.5 cm. in diameter.

PREPARATION.

Buri straw is prepared from the young, unopened leaf of the buri palm. The coarsest straw is made by separating the leaflets from the midribs and drying them in the sun. A higher grade straw results from boiling them in water. Such straws are suitable only for bayon manufacture and for weaving into coarse mats for baling purposes.

Several methods of bleaching buri straw obtain in various localities. Any exact description of the processes is somewhat difficult, since the persons who produce the straw have no very definite idea of the proportions and quantities of various materials which they use, and often do not care to divulge what they consider trade secrets. In several cases, nevertheless, supervising teachers have succeeded in obtaining fairly exact data on the preparation of buri straw.

However, the same method carried out in different towns seems to result in different qualities of straw. These differences probably result from slight variations in the method of preparation. It has also been found that the age of the leaf, as determined by the length of the stem (petiole), influences the color of the straw produced. In some districts the unopened leaf is not taken if the stem is over two inches in length. In other places, leaves with stems about one foot high are considered ready to cut. It is probable, too, that the composition of the water in which the straw is boiled influences its color. Mauban, in Tayabas province, has the reputation of producing the whitest buri straw. Mr. John H. Finnigan, supervising teacher, attempted to introduce buri straw into the schools of Gumaca, Tayabas, where the buri palm is very plentiful. The work was in charge of expert weavers from Mauban, but only a poor quality of straw was produced. It was claimed that the water in which the segments were boiled, according to the process which is explained later, did not whiten them. It is a fact that in Mauban the water of the town fountain is used to produce the fine white straw. In the several years of his experience, Mr. Finnigan found no place outside of Mauban which produces straw equal in color to the Mauban straw, but he has noted that

the second best straw comes from San Fernando, Gumaca, where there is an especially clear stream of water.

In fact, all reports would seem to indicate that clear, pure water is essential to the production of the finest white buri straw, and only such should be used in all processes of the various methods outlined here.

Plate XXX. Unopened buri leaves.

The Arayat Process.—Mr. Robert Clauson, supervising teacher, has determined the process of whitening buri straw in Arayat, Pampanga, as follows: The segments are separated from the midrib and rolled rather loosely, so that the water may pass between them, in bundles as large around as a plate. These are placed in a large can or vat containing tamarind leaves and alum (see bleaching agents) in water, and the whole is boiled until about one-half of the water has evaporated. During the boiling the buri must be tightly covered with tamarind leaves and not be allowed to project from the water. After this process the rolls are placed in a jar full of clear water and left to soak for three days. The strips are then washed several times in the river during a period of three days, and they are then laid on the grass or along fences to dry after each washing. The oftener they are alternately washed and dried the whiter and tougher will the material be. After the final drying, which should be thorough, the strips are rolled very tightly into bundles.

The San Luis Method.—The method of whitening buri straw followed in San Luis, Pampanga, is described by Mr. James H.

Bass, supervising teacher. The unopened leaves are brought down the Chico River in rafts. The segments are torn from the midrib and boiled for four hours in five gallons of water to which one liter of nipa vinegar, a lump of alum the size of an egg, a handful of tamarind leaves, and a handful of pandakaki leaves (see bleaching agents) have been added. Other steps follow as in the previous process.

The Mauban Process.—The following description is taken from Circular No. 27, series 1911, of the Division of Tayabas. Let the unopened leaves, cut from the stalk, stand in a cool shady place several days, until the sap has well run. Open the leaves and separate the segments from the midrib with a sharp knife. Put these carefully into a petroleum can or other suitable receptacle filled with a boiling solution of two-thirds water and one-third white nipa or coconut tubá vinegar (see bleaching agents). Keep the solution boiling until the segments are cooked so soft that folding them leaves no crease.

Spread the cooked leaves on clean grass in the sun to dry. The drying process may require one or two days. When the segments are quite dry, prepare a jar with clear soft water, and put them in this to soak over night. In the morning remove them from the jar, wash them thoroughly in clear running soft water and place them in the sun. At noon repeat the washing process until the segments open, then dry thoroughly in the sun.

It is customary to roll the buri into coils in order to make it more convenient to store. The dry leaflets may be made flexible for this purpose by laying them on the grass in the night air. After a few minutes they will be flexible enough to roll. Care must be taken to have the segments smoothly rolled. When used, they should be smoothed carefully and then split into the widths required.

The process can also be followed with rice vinegar (see bleaching agents) substituted for the tuba vinegar.

Wash two chupas of rice and cook it in water until it becomes very soft and starchy. Put this in a clean petroleum can and add cold water until the can is two-thirds full, then cover the can and let it stand five or six days. This mixture will become very sour. Strain it through a piece of sinamay or other cloth. Cook the segments in this mixture instead of in the solution described in the first process, and then carry out all the other steps.

The Romblon Process.—In Romblon, great care is exercised

as to the age of the unopened leaf taken for the production of straw. If it is intended to produce bleached straw, stalks having stems about two inches long are selected. In the following description, which was submitted by Mr. R. L. Barron, head teacher, one unopened leaf is taken as a unit. The midribs are removed and the segments are rolled into round bundles, say by fives. These are boiled in clear water for about three hours. The leaves are then placed in a mixture of half a liter of tuba vinegar (or three liters of vinegar made from cooked rice, or one-fourth liter of lemon juice) to which enough water has been added to cover the rolls of buri, and boiled for about five hours. The material is then spread in the sun for three days to dry, care being taken that it is not exposed to rain or dew. The segments are then placed in cool clear water for twelve hours and again placed out in the sun for two days to dry.

THE DYEING OF BURI STRAW.

Buri straw intended for mats is usually colored with the cheap imported coal tar dyes previously noted. It is expected that the new dyes for which the Bureau of Education has arranged will take the place of these. Romblon buri mats, which are the finest in point of workmanship and design made in the Philippines, are colored entirely by local vegetable dyes.

The methods used in the island of Romblon in dyeing buri straw have been carefully investigated by Mr. Barron, and are presented herewith. In each case the unit of material is one stalk of buri for each color. The process of whitening Romblon buri straw has already been described.

For red, unopened leaves having stems three feet long should be selected. The midribs are removed while green, and the leaves are rolled into bundles of convenient size, say by fives. These are boiled in clear water for about three hours, after which the segments are spread in the sun for three days to dry. Care should be taken that they are not exposed to rain or dew. They are then placed in a fluid made by boiling two gantas of kolis leaves (see mordants) in plain water for one hour. The buri leaves remain in the water and soak thus for three days and three nights. The buri leaflets are then placed in a vessel containing two gantas of sappan wood (see dyes), one-half liter of lime water, and one chupa of tobacco leaves. To this a sufficient quantity of plain water is added to thoroughly submerge the buri, and the whole is boiled for eight hours, being stirred at short intervals to obtain a uniform shade of red. The seg-

ments are then removed and hung in the wind for about six hours to dry, after which they are smoothed and rolled.

For yellow-orange, unopened leaves having stems about two inches long are selected and the segments are removed from the midribs and rolled into bundles. These are boiled in clear water for about three hours and spread in the sun for three days to dry, care being taken that the buri is not exposed to rain or dew. The material is then placed in a vessel containing one ganta of powdered turmeric (see dyes), one chupa of powdered annatto seeds (see dyes), one liter of lime water, and sufficient clear water to cover the buri, and is boiled in this mixture for five hours, with frequent stirring. It is then removed and hung in the wind for one-half day to dry, and is smoothed and rolled.

For green, an unopened leaf having a stem about two inches in length is selected. The segments are removed from the midribs, rolled into bundles and boiled in clear water for about three hours. After this, they are boiled in lye (consisting of ashes) for about two hours, the mixture of ashes and water covering the buri during the process. The bundles are then removed from the vessel, wrapped in a bayon, and put in a dark place for 48 hours. The segments are then taken out and hung in the wind for about three hours to dry, and are smoothed and rolled.

The preliminary steps in the production of "black straw" (a cold dark gray) are the same in the making of the green material. The segments taken from the bayon, as described above, are buried three days in black mud, in a rice paddy, for instance. The material is then washed in plain water until clean, and is then boiled for two hours in a mixture of one-half ganta each of the leaves of talisay, indigo, and tiagkot (see dyes), with a sufficient quantity of water to cover the mixture. The whole should be stirred at frequent intervals. After two hours the strips are removed and hung in the wind for five hours to dry. Then they are smoothed and rolled.

TYPES OF BURI MATS.

The Bontoc Peninsula of Tayabas produces great quantities of baling mats and bayons. Bayons are also produced in large quantities in Capiz province. Other localities are of less importance.

Buri sleeping mats are made from the northernmost part of Luzon, in the Bangui Peninsula, to the Sulu Archipelago. For the most part they are woven in small numbers here and there,

Plate XXXI. Fair grade Romblon mat.

in the different towns, sometimes for use in the household in which they are made, often for local trade in the barrios or municipalities. In nearly every province there is at least one town in which the production of buri mats reaches provincial commercial importance. A number of municipalities produce

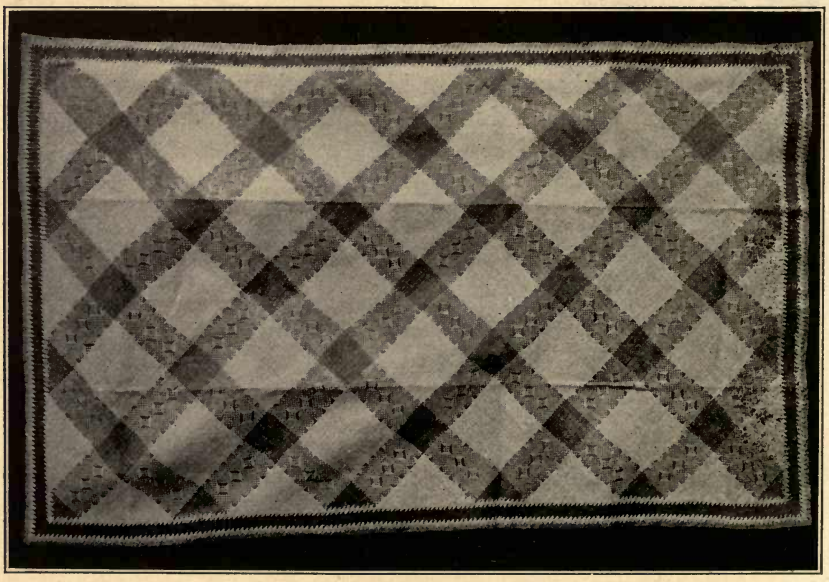


Plate XXXII. Medium Romblon mat.

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them for a fairly extensive trade with neighboring provinces. In most cases these are ordinary products, usually decorated with a few colors in lines or checks of dyed straws, either woven in or embroidered on the mat.

In one region, however, buri mats have reached such a degree of perfection in their weaving and decoration as to have become a distinctive product known throughout the Islands. These are the Romblon buri mats, and they are produced throughout the islands of Romblon. Their central market is the town of the same name. They are distinctive because of the fine white and

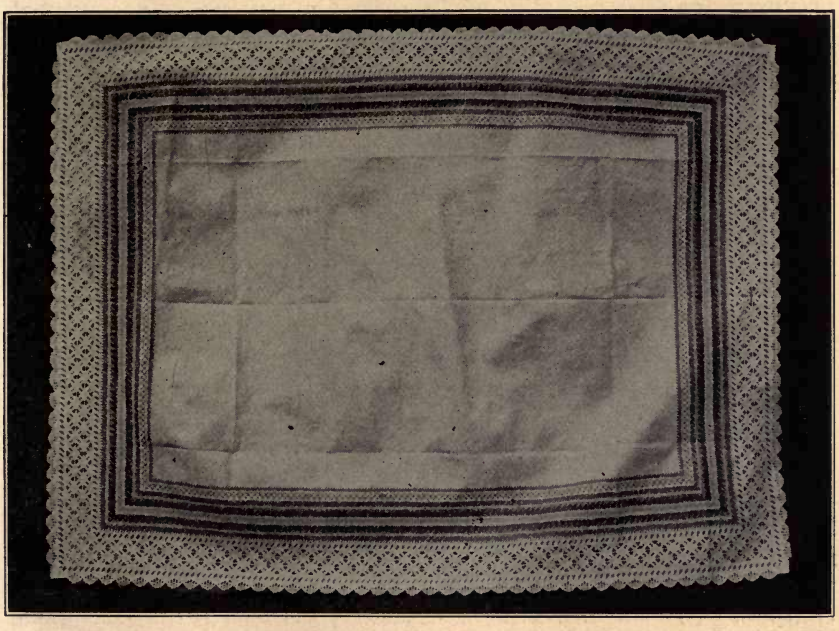

Plate XXXIII. High grade Romblon mat.

colored materials used, and of the designs which are woven in them. In the designing, not only checks and line borders but also plaids appear, and many of the effects produced by floating straws are employed. The Romblon mat, moreover, is most noticeable because of the fancy weave, making a sort of open work along the border, for which these mats are unique. Romblon exports great quantities of mats varying in price from ₱0.25, to over ₱10, and in size from small mats for stands to large decorative mats which cover the sides of rooms.[9]

[9] It is probable that some of the double Moro mats which will be described under the heading "Pandan Straws" are woven from buri straw.

PHILIPPINE MATS

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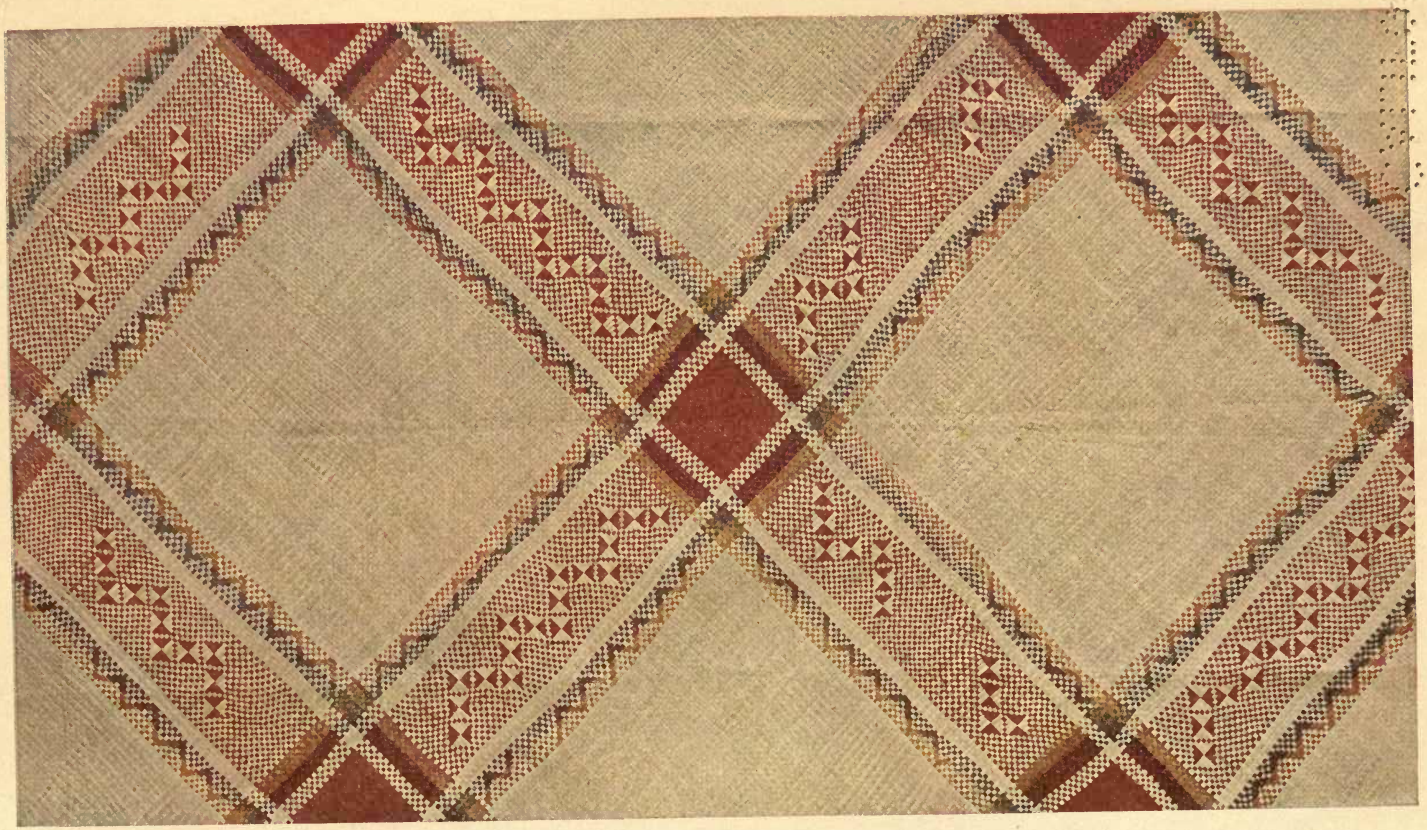

Good Sabutan Mat.

[Reprinted from The Philippine Craftsman, Vol. I, No. 4.]

PHILIPPINE MATS.

PANDAN STRAWS.

Description of Pandans.

Pandans or "screw-pines," as they are sometimes called, are readily recognized by their characteristic appearance.[11] The common forms occasionally planted in pots as house plants and in gardens, or more often found growing wild, have long and rather narrow leaves always supplied with more or less sharp spines which run along both their margins to the very tip. Another row of spines is present on the under surface along the midrib. Bearing in mind this middle row of spines it is impossible to mistake the leaf of the pandan for that of the pineapple or maguey, which it resembles more or less in form and shape. Another very prominent feature of pandans is the presence of air or prop roots which grow from the stem above the ground and are helpful to the plant in various ways. The veins of the leaves always run parallel and in a longitudinal direction. The leaves are never borne on a petiole, but are attached directly, in winding corkscrew fashion, in ranks of three, to the stem.

Pandans are true tropical shrubs or trees. Although also found in the subtropics of Australia, they never occur in other temperate regions except when raised as ornamental plants in greenhouses. Even their distribution in the tropics is limited, as they are found growing wild only in the tropical regions of the Old World, especially on the islands lying between the mainland of Australia and southeastern Asia. They are hardly ever cul-

[11] Due to the efforts of Elmer D. Merrill and A. D. E. Elmer, Botanists of Manila, aided by Prof. Martelli, of Florence, Italy, our knowledge of Philippine pandans has been greatly broadened. It is hoped that interested persons into whose hands this paper may come will help to extend it by sending specimens of pandans for identification to the Bureau of Education, Manila. Such specimens should consist of the ripe fruit and of at least two full-grown leaves from which no spines or tips have been removed, and which have been cut as close as possible to the stem.

tivated, for where they do occur they are found in more than sufficient quantity for the purposes to which they are put. They are essentially seacoast or open swamp forms, generally found at low altitudes and appearing to find a moist, warm climate most congenial to their growth. In the Philippines they occur in all provinces, though not always in sufficient quantity to make them of commercial importance.

The structure of the pandans presents many exceedingly interesting characteristics well worth noticing. Some plants are very low with leaves not wider than a blade of grass, while others form large trees with leaves many meters long and several decimeters wide. Spines generally occur along the whole margin of the leaf, though in a few forms, especially in cultivated varieties, they may be present only at the tip or may be wanting entirely. The marginal spines usually curve forward and vary in size from small, hardly perceptible forms, to large sharp conical structures. At times they are set very close together; again they may be several centimeters apart. Those on the midrib most often curve backwards and may vary the same as the marginal spines. Generally the spines are green in color, though in some species they are pale-green, red, black or white.

Some forms seem to creep along the ground, while others, low and bushy and standing close together, form, with their numerous supporting prop roots, an almost impenetrable jungle. The high tree forms are very striking because of their peculiarly shaped crowns.

The first roots which the pandans develop soon disappear and their place is taken by others. Starting high above the ground, these grow at an angle from the stem and generally reach the soil. They serve the twofold purpose of supporting the stem and of supplying it with sufficient air. If, by accident, the underground roots die off, the plant relies entirely on these air and prop roots for support and food. The strong prop roots are generally of the same diameter throughout, though sometimes they thicken at the ends. Normally they never branch above the ground, but after reaching the soil very often divide. The tip of the roots is protected by a cap, while a layer of cork tissue prevents the drying out of the root body.

The pandan has two kinds of flowers, male and female. The male flowers are arranged in the form of a spike protected by a modified leaf called the bract. They are white in color, crowded together on the spike and consist of stamens which hold the pollen. The flowers do not have the showy colored bracts which forms so prominent a feature in those of many other plants.

The female flowers consist only of the necessary parts. As the pollen occurs in enormous quantities and as the plants generally grow in groups, it is very probable that some flowers are pollinated by the wind. The fact that many pandans have very fragrant blossoms makes it almost certain that in the majority of cases insect pollination takes place. In a few forms that have a very disagreeable odor, pollination is effected by night flying insects.

The fruit commonly has the general shape of the female inflorescence, but as it matures it increases greatly in size. Pandans have a composite fruit made up of smaller fruits called drupes. The most common forms resemble the pineapple with its leafy fruit apex cut off. As is natural, variations from this type occur. Cylindrical, eggshaped, jakfruit-like forms are quite common. The largest may be 60 cm. long and weigh 25 kilos, the smallest only 7 cm. in length and 60 grams in weight. The fruit may occur solitary at the end of a branch, or in groups. The color is green, though some species change to a bright red before maturity is reached. The fruit may have drupes ranging from 12 mm. to 14 mm. in length and these may contain one seed or a number of seeds. At maturity the drupes separate and the fruit falls apart. If the plant occurs along the water, the seeds, when liberated, float about until they rest in a suitable place for germination.

Uses of Pandans.

Pandans are valued chiefly for their strong fibrous leaves, which are woven into mats, bags, and hats. Unless specially prepared, the soft plant tissue between the harder leaf fibers becomes dry and dirty and breaks in time; hence the ordinary pandan bag or mat can not be considered a durable article. However, when treated to a boiling process or when rolled, as explained for sabutan and the pandan of Majayjay, the leaves yield straw which is stronger and more durable than most palm or sedge straw used for the same purposes.

Pandan mats are important articles of domestic commerce in Malaysia, as it is estimated that four-fifths of the total population use them for sleeping purposes. In all places except where palms, like the buri or sedges occur, they yield the most suitable and most easily prepared mat material. Generally the whole leaf is utilized after removing the marginal and midrib spines. The coarsest mats are used in drying out copra, cacao beans, paddy, and such products. Pandan mats are made and used widely in the Philippines.

Formerly, before gunny sacks came into general use, coffee was packed in pandan bags and where pandans did not grow they were introduced and cultivated for that purpose. Even to-day bags from pandan play an important part in transporting sugar, coffee, and other tropical products in and around southern Asia. Few pandan bags are made in the Philippines in comparison with the enormous quantity of bayons woven of buri straw and used to contain domestic rice and export sugar.

Pandans are used extensively for making hats in the Philippines as well as in other parts of the world. In several islands of the Pacific very fine ones are woven from straw consisting of the whole leaf cut into strips. In the Loochoo Islands imitation Panama hats of great strength are woven from the skin of a pandan, bleached and rolled into a straw. In the Philippines numerous varieties of pandan hats are produced, varying in grade from the fine and expensive sabutan to the coarse pandan.[12]

In some other places, as Burma, pandan leaves are woven or sewed into sails. In southern India they are utilized as umbrella covering. If no stronger material is obtainable, the leaves are placed on roofs as thatching, but they do not seem to lend themselves well to that purpose. In countries where they grow, they are often used instead of twine or made into ropes or hunting nets, or into drag ropes for fishing nets. They are said to be excellent paper-making material. In some islands the fibers are separated from the leaf and used by the inhabitants in the manufacture of belts and aprons.

The wood of the tree pandans is too spongy and soft to make a good material for the construction of houses. Still, on small islands, such as the Coral and Marshall Islands, the natives construct their huts from pandan wood. Generally, it is used only for rough, temporary work. In some localities the soft interior part is removed to make water pipes. Again, because of its lightness, the wood is used by the people on the many islands of the Pacific to buoy their fishing nets.

Pandan roots are employed for various purposes. If sufficiently thin they are used, after being cleaned, for making baskets. The roots may also be pounded out, cleaned and made into brushes for painting or whitewashing houses. They are sometimes so employed in the Philippines. They are also used for cordage. A medicinal oil is sometimes obtained from them.

[12] Bulletin No. 33, Bureau of Education. Journal of Science, Manila, Vol. VI, Sec. C, No. 2.

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The flowers of some pandans, especially those of *Pandanus tectorius,* are extremely fragrant. This plant is the most widely distributed of the pandans and is the most frequent pandan found along the seacoast and in low altitudes. Some botanists claim that the male flowers of this species have the sweetest odor known among plants. So powerful is their fragrance that by it sailors can often tell the presence of land before they actually see it. The natives in some places use the flowers in making an aromatic water, or, by distillation, a volatile oil, known as keura oil, which is used medicinally for rheumatism.

Certain pandan fruit is extremely oily and serves at times as a subtitute for butter. The sap has the taste of sweet apples and is relished by the inhabitants in many islands. In some places it is even made into fruit jam.

The very young leaves, especially those surrounding the flowers, are eaten raw or cooked, and constitute an important article of diet when a famine sweeps India.

Plate XXXIV. Common pandan along Pasay Beach, Rizal.

Kinds of Pandans.

The common seashore pandan.

In a walk of half a mile or, at most, a mile along the beach of any of the seacoast provinces in the Philippines, one is almost sure to come across *Pandanus tectorius.* A map showing the distribution of this pandan would therefore be practically an outline map of the Islands. The species does not grow in nipa swamps, though immediately back of them it will be found well established. Neither could one expect to find it in localities where the cliffs come down abruptly to the sea, permitting only the existence of vegetable life of the lowest form.

Pandan is its usual name in the Philippines. In Zambales it is called "panglan" or "panglan babai." Another name is "pangdan."

The stem is not very strong, and reaches a height of from 3 to 6 meters. It is generally supported by aerial roots. The leaves

are of medium thickness, on the average 1.35 m. long and 6 cm. wide. They are provided with strong sharp spines about 5 mm. in length. These are curved forward and are as much as one centimeter, or a little more, apart. The spines on the under surface of the midrib are shorter and farther apart, but bend in the same direction. The male flowers form a spike and these are surrounded by very fragrant leaves called spathes. The fruit is 20 cm. long, 18 cm. wide, and contains from 50 to 80 drupes, each about 5.5 cm. long and 2.5 to 3 cm. wide. The upper half of the drupes are free but close together. There are small furrows on the tops of the drupes, rather deep but not very distinct. When ripe the fruit has a fine red color and the drupes fall from the head.

Plate XXXV. Fruit of the common pandan.

Pandanus tectorius is of considerable importance in nearly all parts of the world where it grows, and it is devoted to most of the uses already noted for pandans in general. In certain places, large industries are founded on it. In India, the leaves are cut every second year and made into large bags. Hats are produced from it in the Pacific Islands, those from the Hawaiian group being especially well known. It is probable that the imitation Panama hats of the Loochoo Islands are also woven from a material (raffia) prepared from the common pandan. In the Marshall Islands it is recorded that forty varieties of this species have been evolved in the course of planting and cultivation for industrial purposes.

From the information submitted with the specimens received in the Bureau of Education, it is to be judged that the economic importance of the common pandan in the Philippines is of but little consequence. Though widely used, no large or even local industries are based upon it. A scattering production of hats, mats, and bags is reported in Abra, Union, Zambales, Mindoro, Bulacan, Rizal, Batangas, Sorsogon, Iloilo, Antique, Oriental

Negros, Cebu, Leyte, and Sorsogon provinces. Near Badoc, Ilocos Norte, and along the Abra border the Tinguian people make mats from an upland variety for local trade. In Balayan, Batangas, the leaves are used for thatching. In Surigao they are also made into baskets. In most processes the preparation of the straw consists of cutting the leaves into strips and drying them. In Zambales, however, it is reported that the leaves are flattened, pressed, split, and rolled. In Mindoro, they are soaked in water and dried in the sun before being cut into straw. It is probable that much better material could be prepared from this pandan if such processes as are used in the making of sabutan straw and straw from the Majayjay pandan were followed.

Plate XXXVI. Sabutan at Tanay, Rizal.

Judging from the results obtained in other countries, it would seem that if suckers of the common pandan were taken, in the districts in which it grows, planted, and cultivated, varieties would result which would be much better adapted for industrial purposes than the parent stock. Indeed, it is probable that sabutan, the Philippine pandan of greatest economic importance, is a variety which is the result of generations of planting, still closely resembling *P. tectorius* but differing from it in its leaves, which are thinner, longer, of finer texture and of greater strength. It is possible also that sarakat, the economic pandan of the Bangui Peninsula, Ilocos Norte, is a variety of *P. tectorius*.

VARIETIES OF THE COMMON PANDAN.

SABUTAN.

Botanical.—It is a question among botanists whether the pandan known as sabutan is a variety of the common sea-shore pandan (*P. tectorius*) or whether it has sufficient distinctive characteristics to entitle it to be considered as a separate species (*P. sabotan*). Botanists have not as yet succeeded in securing a fruit of this pandan, which could settle the question, and it is

very doubtful whether the fruit will ever be found.[13] Prof. Ugolino Martelli of Florence, Italy, an authority on pandans, considers sabutan to be *Pandanus tectorius* var. *sinensis*. This classification is for the present accepted, as most evidence is in favor of such determination and in this paper sabutan is therefore considered to be a variety of the common pandan, the chief change in which, through generations of planting, has been in the production of a leaf stronger, thinner, and of finer texture than that of the parent stock.

The sabutan plant is never found growing wild, though after it has once been started and rooted it will endure neglect and even

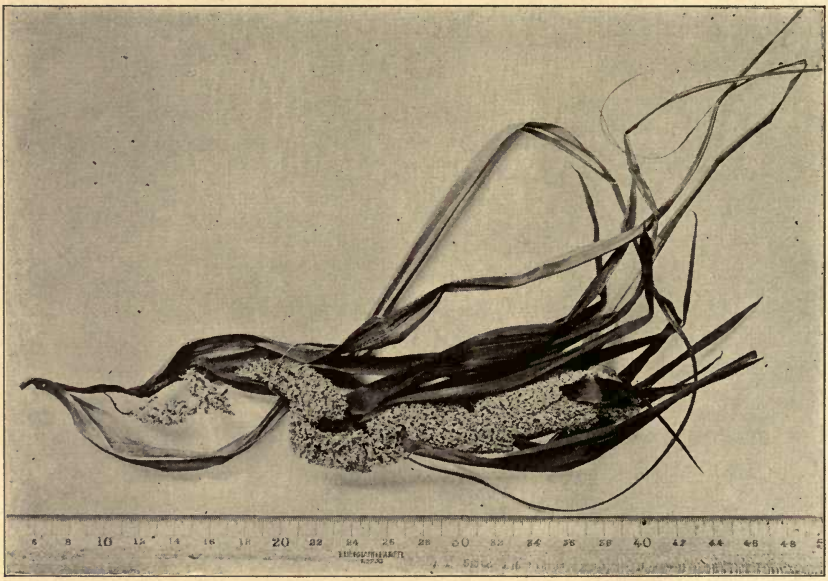

Plate XXXVII. Flower of sabutan.

abandonment. It produces better and finer leaves, however, if it receives some care and attention. In the towns of Tanay and

[13] To settle, if possible, the question of whether sabutan flowers and fruits, inquiries and investigations on the ground were made in Tanay and Pililla by a representative of the General Office of the Bureau of Education. The people interviewed in these towns were positive in their statements that they had never seen the fruit of this pandan though they did remember seeing the flower. Every possible effort was made to get accurate, reliable information. An old man was engaged as guide and a male inflorescence of sabutan was found in a patch located on a hillside, under the shade of trees and surrounded by considerable underbrush. The patch, according to the statement of the old man was older than he could remember; the age of the guide was, perhaps, between sixty and seventy years. The flowers were odorous and covered with small brown insects almost hiding the inflorescence.

Pililla, Rizal Province, and in Mabitac, Laguna Province, and in all the towns along the lake shore as far as Paete, the suckers of the plant are set out in small plots of ground surrounding the houses of the people. These form patches which in several years (depending mostly on soil conditions) yield pandan leaves large and fine enough to be used in the manufacture of hats and mats. The ideal location for sabutan is along the banks of streams where it can get the benefit of the light shade of bamboo or plants that happen to grow in the vicinity. Ordinarily, good results are obtained by planting the suckers of sabutan in a loose and moist, but well drained, soil. Plants are set out one meter apart in each direction, as they spread considerably. They need some shade, especially when young, but not the heavy shade of an abacá or banana grove.

The plant grows to be from 2 to 4 meters high. The leaves are fine in texture, about 2 meters long and as wide as 6 centimeters. Spines occur on the margins and on the under surface of the midrib. The male inflorescence procured from Tanay by the Bureau of Education is similar in appearance to that of *Pandanus tectorius* and is about 27 centimeters long. At varying distances on the flower stalk are leaves (bracts), thin and fine, from 10 to 24 centimeters long and with fine spines on margins and midrib. The flowers have a pleasant, though not very strong, odor.

Status of the sabutan mat industry.—As an industry, the weaving of sabutan mats is confined to the towns of Tanay and Pililla, in the Province of Rizal. The beginnings of this industry go back beyond the memory of the oldest inhabitants or even of their parents. It is probable that, as the people state, mat weaving has been carried on ever since the towns were founded. Tanay is the older of the two and it would seem (though reliable historical data of this kind are difficult to obtain) that the town was the first to engage in sabutan mat weaving and is probably the mother of all the sabutan industries carried on around Laguna de Bay.

The present condition of the mat-weaving industry of these two towns, however, is precarious; it appears to be gradually dying out. The fabrication of sabutan hats has been introduced from Mabitac, Laguna Province, into Pililla, with the result that the younger generation is entirely engaged in making hats, and the relatively small number of mats produced is being woven by the older women who have not cared to learn the new art. As yet no hats are made in Tanay, but the work is being taught in the schools and from conversation with people of the town it is judged that they are becoming interested also.

The disappearance of the sabutan mat industry would be very unfortunate, for the products are the finest samples of the mat weaver's art produced in the Philippines. The mats are of fine straw; the natural gray of sabutan is pleasing; the designs used are good; and the colors are usually well combined. The favorite patterns consist of heavy plaids with some of the stripes containing sub-patterns produced by floating straws; the simplest ones have narrow border designs in straight lines. The most expensive mats are decorated with embroidered designs. The combination of colors in these is sometimes not pleasing and the designs themselves are not of special merit. However, if better ones are substituted, these mats should be excellent for a foreign trade demanding expensive articles of this nature. Unlike most

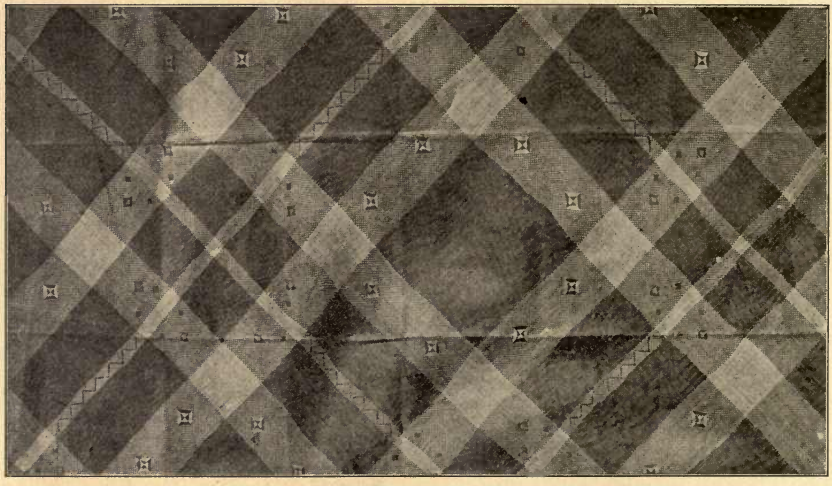

Plate XXXVIII. Cheap sabutan mat.

Philippine mat industries, this one has not as yet been affected by coal tar dyes, and only vegetable dyes, found locally in the town or in the forests, are employed. The straw dyes very well and as a consequence the colors produced are even throughout the mat; nor have any of the shades that brilliant effect or "off color" which is so distasteful in certain fibers. The colors obtained are only fairly fast in the light, however, and it is probable that the new coal tar dyes will be faster and cheaper. In point of durability, sabutan mats would be superior to all others produced in the Islands if woven of double straws. In price they now vary from forty centavos to thirty pesos, the ordinary ones bringing from ₱1.50 to ₱2.50.

If the industry is to be preserved intact, however, something must be done to give it vitality, for the weavers know from

experience of neighboring towns that more money can be made from weaving hats than in the fabrication of mats, and they will naturally change to the more remunerative article. Unlike most other weaving industries, the craft has not as yet been organized in Tanay. The production of mats has been more or less haphazard, with but little supervision by any person resembling the broker usually connected with household industries. The weaver on completing a mat sells it in the market or to some storekeeper. Up to the present time, the chief trade in these mats has been at Antipolo in May during the "romeria" or annual pilgrimage to the shrine of the Virgin of Antipolo. Certain persons in Tanay have made it a practice to gather up a store of mats and take them to Antipolo for sale there during the fiesta. A few of them are on sale in Manila and in neighboring provinces. Of late, however, persons have appeared who are taking up the industry more thoroughly as brokers and it is to be hoped that the workers will be organized into some better system for production than now exists. There is a large opportunity not only for supervision but also for division of labor. At present the men of the house cut the leaves, and each weaver (all the weavers are women) carries out the rest of the process. There would be a considerable saving of time if certain persons devoted themselves to the preparation of the gray straw, and the dyeing were left entirely to certain other workers. In this way the weavers of the mats would be engaged only in the actual fabrication of the article and much time would be saved to them.[14]

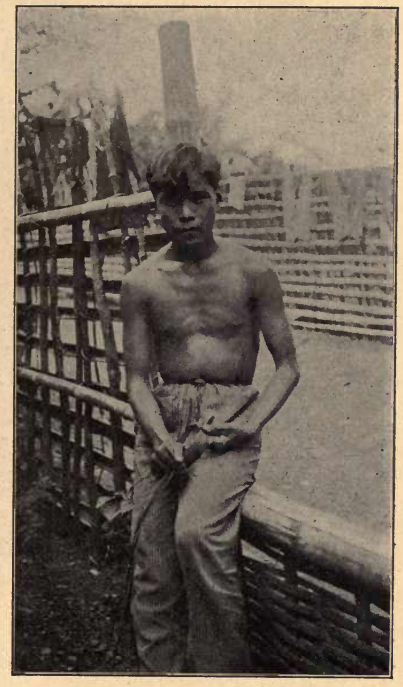

Plate XXXIX. Smoothing sabutan, Tanay, Rizal.

[14] Plain double pandan mats, the material of which resembles sabutan, are imported from Singapore and sold by Chinese storekeepers in Manila in large quantities. They are roughly made and the fact that they are double permits the unfinished edges to be turned under and sewed down with coarse red cotton twine. They sell for a little less than the plain, single, Tanay sabutan mats with finished edges.

Planting, maturing, and yield of sabutan.—The plants from which the straw mats at Tanay are made are set out in plots near the houses of the workers. The suckers are planted in April at the beginning of the rainy season, and, while it is always stated that straw prepared from the leaves grown in the shade is best for weaving, yet the plants are never intentionally set out in the shade but are planted wherever an unoccupied plot of ground is obtainable. As a matter of fact, the patches to be seen in the sabutan towns grow in a semi-shade such as one would expect to find in yards where the usual ornamental and fruit trees and banana plants grow. Much of the sabutan is in the sun from morning to night; some is shaded during all or part of the day. The suckers mature leaves in the third year [15] but these are cut off and thrown away as useless and it is not until the fourth year that the lower leaves can be stripped into straw. Harvest takes place every four months, five or six leaves being obtained from a plant at each cutting. The plants are never irrigated but it is to be noted that the soil around Laguna de Bay is very moist and that the water table is close to the surface with a good seepage from the hills which are near the shore. It is probable that the plants differ in their production of leaves because some have many more branches than others and the climatic and soil conditions affect the yield.

Preparation of the straw.—The best straw is prepared during the dry season, because at this time there is sufficient sunshine to produce a good colored material. As a consequence the workers prepare a large quantity at that season and store it in or under their houses, wrapped in mats.

The leaves used are about 2 meters in length and 6 cm. in width. The central thorns on the back of the leaves are removed by cutting away the midrib. Two lengths about an inch in width are thus produced from which the outer rows of thorns may or may not be removed, according to custom. The lengths thus obtained are left in the sunshine and wind for about half a day to render them more flexible, after which they are cut into straws. For this purpose there is used an instrument consisting of a narrow wooden handle about $2\frac{1}{2}$ cm. wide at the base, into which narrow sharp teeth, usually of steel, are set.

[15] It is very difficult to obtain definite information with exact figures. These statements were made by a woman expert in weaving mats, and owing to the frank answers to the questions put, her information seems more reliable than that of the usual weaver interviewed. Other persons state that from two to six leaves are taken from a plant every month.

Brass and even hard woods can be used for teeth. The point of the segment being cut off, the base is grasped in one hand, the inside of the segment being turned toward the operator. The comb-like instrument is forced into it about 4 cm. from the end of the base and the teeth are held against the first finger by pressure of the thumb. The leaf length is then drawn up by the other hand and is cut into straws depending in width upon the fineness of the comb used. If the leaves are too young they will break in this process. The stripped segments are then usually tied up into bundles as large around as the fist, and hung in some shaded place exposed to the wind. The length of time occupied by this process varies. In some places it is omitted, though it seems to be always carried out in Tanay.

Plate XL. Weaving sabutan mat, Tanay, Rizal.

The bundles are then undone and the worker, holding the uncut base of each length in one hand, runs the straw between his fingers and the sharp edged ruler-like piece of bamboo held in the other. This is done several times and results in the removal of considerable moisture, the prevention of wrinkling, and greater pliability of the straw.

There are several variations in the processes followed for boiling sabutan. In the Province of Laguna a fistful of the stripped lengths with bases still attached are rolled up into a bundle and placed in fresh water in order to remove the coloring matter—in some places in clear, running river water, in other places in a can of clean, fresh water—for about twenty-four hours; the water is changed several times. In the last method the process is discontinued when the water remains clear. Bun-

dles are then placed in cold vinegar, water or lemon water to which green tamarind fruit has been added to make the color of the straw lighter and to toughen it; the water is brought to a boil. Bamboo is used as fuel, as that fire is not so hot as a wood fire. The length of time required for cooking differs. One good authority states that it should be stopped when the odor of sabutan can no longer be detected in the vapor, which occurs after about fifteen minutes boiling. This authority also states that the straw should be removed when it takes on a reddish hue. Many women put the straw into clear boiling water to which nothing has been added. After this process the straw is allowed to cool, is washed several times in clean, fresh water and is spread in the sun to dry, whereupon it assumes a gray color. If there is no sun the cool straw must be kept in fresh water which is changed every twelve hours until the sun appears. If a greenish shade is obtained the process has not been correctly carried out. Straw from dark green, thick, old leaves, or from those grown in the sun, is often reddish brown in color.

The boiling processes noted are those used in the preparation of straw for mats. The process followed in Tanay has been described by Mr. Amado Simpoco, principal of the Tanay Central School. The stripped lengths, after being wilted and drawn over the sharp edged piece of bamboo, are made up into fist bundles, tied at the middle and placed in a large copper pot 61 cm. in diameter and 84 cm. in depth and containing about 25 bundles. The pot is filled with water and the sabutan is boiled for 24 hours, care being taken that the straw is always covered. After boiling, the bundles are removed and untied and the strips are hung in the shade or in the house to cool; afterwards they are placed in the river for a day and are then washed carefully and dried thoroughly in the sun. The gray straw thus obtained is stored in bundles, still attached to the uncut bases, and is left in the air for three or four nights before it is woven into mats.

Dyeing sabutan.—Mr. Simpoco has also made a careful study of the methods used in Tanay in dyeing sabutan straw, and the results of his efforts are presented here.

Red orange: For the production of red orange straw the gray material, prepared as outlined above, is first treated by steeping in water containing kolis leaves and twigs. The leaves and chopped twigs are pounded in a mortar and are placed together with the sabutan in a large receptacle capable of containing from 25 to 30 bundles, filled with water. The material is allowed to remain in the receptacle for four days. Early in the morning of the fifth day the straw is removed and hung in a shaded

place until dry and is made up into bundles tied tightly at the larger end.

The dye fluid is carefully prepared. Chips of sappan are boiled in a large copper pot for one day. A quantity of turmeric roots and annatto seeds are pounded separately in mortars until they are reduced to a very fine state. These are then separately treated with water and pressed, the result being a turmeric water and an annatto water. These two are mixed and poured into the boiling sappan. After about 25 minutes the bundles of sabutan are placed in the pot and the whole is allowed to boil until every part of the fiber is uniformly colored. After having been boiled sufficiently, the bundles are removed and placed in a large basket, later to be dried in the shade. They are left in the night air for three or four nights and are then rolled up in coarse mats. The shades procured vary with the proportions of the dye materials used. Some are a decided orange, others are light yellow.

Yellow: Yellow straw is produced in the same manner, using turmeric and annatto only.

Red: In the production of red straw the bundles are treated with kolis leaves in the same manner as in the preliminary process for red-orange straw. In a pot capable of holding 25 fist bundles of sabutan, four gantas [16] of finely chopped sappan are placed. Over this are placed 15 bundles of the straw, which in turn is covered with one ganta of chopped sappan. The remaining 10 bundles are then added and covered with still another ganta of sappan. The pot is filled with water and set over a fire for from twelve to fifteen hours. Care is taken that the bundles are always kept under the water and that all parts of the material are uniformly colored. The loss by evaporation is counterbalanced by adding water from time to time. When well colored, the straw is removed from the pot and placed in a large basket for a day and is then hung in the sunshine to be dried. It should be allowed to remain in the night air; when thoroughly dried it is rolled in coarse mats.

Black: Black straw, a warm dark gray, is prepared from the red material. Buds of bananas, leaves of kabling, talisay, camagon, and the castor plant are pounded in a mortar and are mixed with fine particles of black clay such as can be obtained from rice paddies. Sappan water, made by boiling sappan chips, is then added to the mixture and the entire mass is placed in a large receptacle for a day. Red straw is put into this mixture

[16] Three liters equal 1 ganta.

and allowed to remain for two days. It is removed on the third day and again returned to the mixture on the fourth day. On the fifth day the straw is finally removed and placed in the sun, being kept in the air at night.

Coal tar dyes are used in the production of green and purple straws. These are purchased from the Chinese stores. The prepared gray fiber is also employed with these dyes. The usual method of boiling in a tin can until the desired shade is obtained, is followed. The straw is dried in the sun and kept in the night air. Colors produced are not so uniform or so satisfactory as the others described and are seldom used.

Plate XLI. Pandan of Majayjay.

Weaving the mats.—Before weaving the mat the worker runs the straw over the ruler-like piece of bamboo as already explained, and removes the uncut base to which it has been attached during the various processes of preparation, bleaching, and dyeing. One side of the mat is first woven the entire length, and is finished by having the edges turned in. This edge is then placed in a slit made in a narrow stick of wood and is tied in place with strips of sabutan straw running around the stick and through the mat. The mat is allowed to remain attached to this stick until it has been completely woven. As weaving proceeds, the finished part is rolled up on the stick, thus being out of the way of the weaver. This arrangement also serves to keep the mat in position during weaving and prevents it from getting out of shape. Single straws are used and consequently the mat has a right and a wrong side.[17] The most expensive mats, which are seldom made, are double and of very fine material.

[17] Sabutan lends itself easily to the fabrication of pocketbooks useful as purses, card-cases or cigarette-cases. From it can also be made very pretty, strong, durable and useful handbags. The weaving of both of these articles has been taken up in the schools of Tanay, but it is not as yet commercial in the town. Sets consisting of a handbag and a pocketbook in the same color and design are attractive.

The extension and cultivation of sabutan.—For a number of years there has been an increasing interest throughout the Philippines in the propagation of sabutan. Teachers in various places have procured suckers from the towns along the east coast of Laguna de Bay, and have planted them out with the idea of having their own industrial material close at hand. Many of these attempts have been failures, since not enough information had been obtained concerning the soil and moisture conditions necessary for the cultivation of the plant. The Bureau of Education has therefore gathered as much information as possible on the cultivation of sabutan, based upon the experience of various persons who have attempted planting it.

It has been found that, in those regions having a dry season, the suckers should be planted early in the rainy season so that they may become well rooted before the rains stop, or else water should be provided through irrigation ditches. In nearly all cases it has been reported that the loss of plants resulted from lack of water at the planting period.

It is reported that difficulty is found in making the suckers live if planted in the sun, but that, when well established, those so planted grow and produce suckers better. As has been previously noted, no special attempt is made to set the plants out in either the sun or shade in the towns around Laguna de Bay, but all weavers state that leaves grown in the shade are the best for industrial purposes.

Sabutan plants need a moist but well drained soil. They should be set out about a meter apart each way (that is, the rows one meter apart and plants one meter apart in the row), since they spread out considerably when they become older. Where sufficient moisture does not exist, irrigation should be provided. If it is decided to shade the suckers, plants such as the papaya, having long roots rather than surface roots, are best. No sabutan plants should be planted within 6 feet of the papaya.

It is probable that with cultivation the plants will yield leaves suitable for straw in from one and one-half to two years, the time to mature depending upon the conditions noted in the preceding paragraphs.[18]

[18] Sabutan suckers may be purchased from several firms in Manila at ₱5 per hundred, freight prepaid. In shipping, the plants are packed in baskets so that they can be easily handled. It is believed by persons who have received shipments from this source that the plants will remain in good condition out of the ground for a week or more during shipment. Hence it is not advisable for places more remote than one week from Manila to order any of these plants. For further information see Circular No. 82, s. 1911, Bureau of Education. It is probable that suckers can be obtained from the cultivated plants in about a year after they are set out.

Sabutan types.—In several places in the Philippines there are pandans which yield leaves similar to those of sabutan. It is probable that none of these are the true sabutan. The most important one is that growing along the northeastern shore of Tayabas Province. Mats are made at both Casiguran and Baler, and enter to a small extent, the interprovincial trade with neighboring provinces. It is stated, however, that these regions abound in the species of pandan from which the mats are made. Sabutan type mats are also reported made at Palanan in Isabela Province, and a trade is carried on in them with neighboring towns.

Other pandans reported under the name of sabutan and resembling it more or less have no commercial importance.

SARAKAT.

Sarakat is a distinctive pandan of the Bangui Peninsula of Ilocos Norte. The climate of this region differs from the rest of Ilocos Norte in that it has rainfall practically throughout the year, receiving as it does the benefit of the northeast monsoon which is cut off from the country to the south. It has not as yet been determined whether sarakat is to be described as a new variety of *P. tectorius* or is to be designated as an entirely new species.

From mats submitted to this office, it is to be judged that sarakat straw is as fine as sabutan. In fact, the material is so thin that even though the mats are woven of double straws they are no thicker, and are a good deal more pliable than all other commercial pandan mats, sabutan excepted, produced in the Philippines. The upper surface of pandan straw is glossy, and the under surface is rough. In making the double straw, the two rough surfaces are placed together so as to expose both glossy ones. Hence, unlike the sabutan, both sides of sarakat mats are similar in appearance. The material, however, is not so strong as sabutan.[19]

The mats are not decorated either by weaving in colored straws or by embroidered or border designs. In price they vary from about ₱1 to ₱2.

Mr. Petronilo Castro, formerly Supervising Teacher of Bangui, has stated that that town supplies most of the mats used by the people of Ilocos Norte. Some buri mats and a few "pandan" mats (probably from the common seashore variety) are made.

[19] At this writing no data are at hand as to the preparation of sarakat straw, but it is probably made simply by drying. It is possible that much stronger and more pliable straw could be obtained if a process such as is used in the preparation of sabutan were followed.

The sarakat mats exceed those of pandan in numbers and in commercial importance and are more beautiful and stronger. The demand for the mats is great and many people are engaged exclusively in their fabrication.

THE PANDAN OF MAJAYJAY.[20]

This pandan (*P. utilissimus*) is known in most places where it grows as "pandan" or "pandan totoo," the true or tame pandan. It is extensively used in Laguna and Tayabas and is remarkable for its very large leaves and its heavy fruit. The tree occurs in groups in dry ground but thrives best in half shade near streams. It attains a height of from 4 to 8 meters. The trunk branches toward the top and is supported by a few short and thick prop roots.

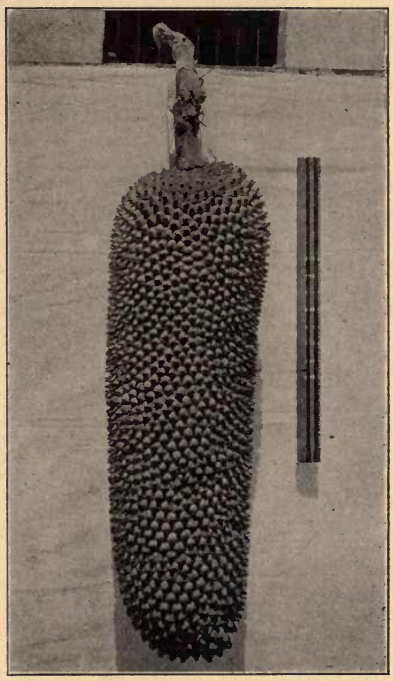

Plate XLII. Fruit of Pandanus utilissimus (Majayjay).

The leaves are often 5 meters long and 2 decimeters wide. The lower part of the older leaves stands up straight, while the upper half droops. The younger leaves are erect with only their tips bent down. The leaf spines are short, blunt, and conical.

The fruits look like the jakfruit and are very large and heavy, being often 6 decimeters long and 2 decimeters in diameter and weighing at times 25 or more kilograms. The drupes ripen slowly and gradually; they are red in color when fully mature and possess a peculiar faint odor. It takes some time before all the drupes are shed, and in a grove of fruiting trees they can be found in all stages of maturity during the month of May.

P. utilissimus is found growing wild throughout the plateau region of Majayjay, Luisiana, and Cavinti in Laguna Province, and extending into Tayabas Province. It is only the leaves from those plants which have been set out in plots, however, that

[20] Vol. I, No. 1 of the Philippine Agriculturist and Forester. A description of the plant occurs in Mr. A. D. E. Elmer's leaflets.

are utilized in the making of mats, hats and telescope baskets. Like sabutan, this pandan grows best in the half-shade near streams, and leaves grown in the sun are considered inferior. Nevertheless, no attempt seems to be made to select a locality for their propagation, and plots are planted wherever land is available. This pandan will not live in stagnant water and is particularly adapted to hill-sides where there is a constant flow.

The most satisfactory statistics on the propagation of *P. utilissimus* are obtained from Cavinti, where the plant has been introduced within recent years and suckers are still being brought in from other towns. It is stated that suckers one-half meter in height mature in about three years, while suckers one meter in height or over will produce suitable leaves in one year or less. The most satisfactory results are obtained by transplanting the mature plants, since leaves are obtainable in a few months and in half a year suckers large enough for transplanting are produced. It is stated that in setting the plants out, the undergrowth is cleared away and the suckers are placed in the ground about 1½ meters apart. Some attention is given to the young plants such as loosening the earth around them; but as soon as they obtain a good foothold no cultivation is attempted.

Plate XLIII. Rolling pandan, Majayjay, Laguna.

Usually weavers own their patch of pandan from which the leaves are obtained for making the straw. Several workers sometimes have a patch in common and the few weavers who do not own pandans themselves must purchase. The leaves are sold on the tree, the purchaser cutting them off with a bolo. The price is from 20 to 30 centavos per hundred, depending

upon their size, softness, thickness, and imperfections. The longest, thinnest, darkest green leaves, with the fewest imperfections, are considered the best and cost the most. In Cavinti, where the leaves are imported from Luisiana and Majayjay, the price of the best leaves is 50 centavos per hundred. The estimates of the number of leaves yielded by a plant in a year differ considerably. By some it is stated that on the average one leaf is produced per month; others report that from three to five leaves are gathered in from three to six weeks.

The thorns are removed from the edges, and the midrib is cut away, thus reducing the leaf into two halves, each of which is again divided. These strips are placed in the sun for half a day. The unique process in the preparation of this pandan straw is the rolling which occurs at this point. While it is probable that any roller with sufficient weight could be used, that employed in the pandan districts of Laguna is the primitive "iluhan" by which sugar-cane and copra are also crushed. It consists essentially of three heavy wooden horses, in the grooves of which a log, heavily weighted with stones, rotates. The pandan lengths are placed in one of the grooves underneath the log and so rolled. The object of the process is to make the material thinner and more pliable. Straw is stripped from the lengths thus prepared by the use of the gauge.[21] The straw is then further dried in the sunshine and is ready to be woven. Sometimes the lengths are stripped before being rolled, hence the straw is left in the sunshine for another half day and then placed under the log in the iluhan.

Mats are woven in Majayjay and Luisiana only, the weavers of Cavinti devoting their entire time to the fabrication of hats. The mats are woven of single straw, but they are fairly thick and not at all limber. The number produced per week runs probably into the thousands, of which about 75 per cent are made of coarse straw and are intended for use in drying palay, copra, etc. These mats are known as "bangkoan," a word having about the same significance as "bastos;" that is, coarsely or poorly made. The finer and better made mats are intended for use as sleeping mats and for the floor. They are decorated with colored buri straw, usually in some shade of red produced by mordanting with kolis leaves and boiling with sappan wood as explained for buri straw. Occasionally, other colors are used, produced from the imported coal-tar ("Chino") dyes, but in all cases the shades produced are not very pleasing. The deco-

[21] It is probable that the improved Andes stripper can be utilized in the cutting of pandan straws.

rations are embroidered in, and consist of simple borders in straight lines with an open center design of somewhat the same pattern. When first woven, the mats are usually of a dark green color. Before being sold, they are placed in the sun, which changes them to a grayish color somewhat resembling sabutan. After long use, however, the final shade is yellowish green.

There seems to be but little division of labor in the production of these mats. Usually the whole family goes out into the patch and cuts the leaves, removing the thorns before bringing them home. Only women weave the mats. In Majayjay a few workers color their own buri straw used in decorating the mats, but for the most part this material is obtained from dyers, one a Chinese, the other a Filipino, who prepare it for sale.

The weavers are independent of advances by brokers and sell their product to Filipinos or to the representatives of Chinese merchants in Pagsanjan and Manila. A few weavers take their mats to Lukban, whence they are distributed over Tayabas Province, but many more are gathered up by these brokers and sold in the market at Pagsanjan. The mat market there usually occupies one whole sidewalk running the length of the market building.

The pandan mats of Majayjay and Luisiana are notable for their strength and durability, and are excellent for the floor or bath. In price they range from ₱0.50 to ₱5.00. The usual price of the decorated mats is ₱1.50. The demand continues brisk and prices have recently risen. The weakest point in the mat at the present time is in the colored buri straw used to decorate it, for this tears long before the pandan shows signs of wear. If colored sabutan straw is substituted for the buri, a much stronger and probably more pleasing article will result.[22]

KARAGUMOY.[23]

The pandan *P. simplex,* known as "karagumoy" or "carogumoy," is the economic pandan of the Bicol peninsula in southern Luzon. It is usually found growing in well drained soil under the shade of banana and abaca plants and areca palms. It needs this protection because the leaves are easily broken or ruined by hard winds. The leaves are generally longer than those of sabutan (they are 2 meters to 3½ meters in length) and

[22] Arrangements are now being made through the schools for the introduction of sabutan plants into the towns of Majayjay and Luisiana.

[23] Most of the information on "karagumoy" is taken from the report submitted to the Director of Education by Mr. Ralph E. Spencer.

are but from 6 cm. to 10 cm. wide. They are very thick, being practically as coarse as the leaves of *P. utilissimus*. They bear stout spines on the midrib and along the margins, from two centimeters to three centimeters apart. A fungus disease often attacks them, causing dry hard patches, and not only spoiling the color but also making the material so brittle that it breaks in the preparation of the straw.

The plant is propagated by means of suckers in patches seldom over a half hectare in extent and often consisting of a few plants back of the house. The suckers are set out in rows and are probably one year old when the first leaves are taken, though the workers disagree on this point. At a specified time, from eight to fifteen leaves are cut from the plant each year; at other periods, two or three may be taken from the same plants. Most of the leaves are harvested during the rainy season. Karagumoy leaves have a commercial value in many of the places in which the plant occurs. In Tabaco, Albay, women cut the leaves and carry them in large bundles to the market, where they are sold at prices usually varying from 8 to 12 centavos per hundred.

Plate XLIV. Karagumoy.

Throughout the Province of Albay mats are made from karagumoy, and in some towns the industry is of considerable importance. For instance, in the barrio of San Lorenzo in Tabaco, mats may be found in the making in nearly every house. In Sorsogon, too, the industry is widespread though not so important commercially. In Balusa the production is large enough to supply the local demand and leave a surplus for export to neighboring towns. In the Bicol provinces karagumoy is considered the best of all straws for the production of mats. In price the mats vary from thirty to ninety centavos, according to fineness.

In preparing the material, the spines and midrib are first removed and the leaves are divided into four strips of about equal

width. The straw is prepared from these with the knife and gauge; it is dried in the shade for a few hours and drawn several times over a piece of bamboo as explained for sabutan in order to make it more supple and smooth. The mats are woven in the early morning and at night, the straw being more pliable then. Attempts have been made in the schools to dye karagumoy but no success has yet been attained. The mats are plain.

BARIU.

The stem of this plant, *P. copelandii*, grows from 4 to 9 meters high. The leaves have an average length of 2.1 meter and a width of 8 cm.[24] Spines occur along the entire margin. Near the base they are comparatively coarse and from 3 to 4 mm. long. Towards the apex of the margins and midveins, the spines are short and close together like the teeth of a fine saw. From 3 to 5 heads generally form on the fruit stalk, each of them from 7 to 12 cm. long and 5 to 7 cm. across, at first pale yellowish in appearance but soon turning red. Their drupes are 14 mm. long and 3 to 4 mm. in diameter. This pandan is found in Cagayan, Benguet, Nueva Ecija, Samar, Bohol, Occidental Negros, Capiz, Surigao, Davao, and other provinces.[25]

This pandan is not of economic importance in central and southern Luzon. In the Bicol provinces it is used to some extent but it is considered inferior to other materials. In parts of the Visayas, such as Bohol, Capiz and Samar, it is utilized to a considerable extent, but cannot be considered of commercial importance. It is the economic pandan of Surigao, but even there its commercial importance is local only.

Table showing comparative measurements of certain Philippine pandans.

	P. tectorius.	Sabutan.	*P. utilissimus.*	*P. simplex.*	*P. copelandii.*
Height of trunk	3 to 6 m	2 to 4 m	4 to 8 m	6 m	4 m.
Leaves:					
Length	1.35 m	2 m	5 m	2 to 3.5 m	2.1 m.
Width	6 cm	6 cm	20 cm	6 to 10 cm	8 cm.
Thickness	Medium	Fine	Thick	Thick	Medium.
Fruit:					
Length	20 cm		60 cm	9 cm	7 to 12 cm.
Thickness	18 cm		20 cm	9 cm	5 to 7 cm.
Drupes—					
Length	5.5 cm		7 to 8 cm	3 cm	14 mm.
Thickness	2.5 to 3 cm		2 cm	1 cm	3 to 4 mm.
Number in head	50 to 80		Many	Many	Many.

[24] The average was obtained by measuring accurately a number of specimens of the species sent in to the Bureau of Education from various provinces.

[25] Its most common name is bariu, spelled also bario, balio, balewe, baleau. In Occidental Negros it is also called balean, barog in Surigao, batin in Capiz.

PANDANS OF MINOR UTILITY.

The species *P. radicans* is reported as olango from Leyte, wañgo in Bohol, owañgo in Surigao and uyagño in Sorsogon. It is usually found growing along rivers and in marshes. The trunk reaches a height of 8 m. and its largest leaves may be 6 m. long and 12 cm. wide. There are from 6 to 10 dark brick red fruits in a cluster. The fruit is 14 cm. long and 8 cm. wide and contains 100 or more drupes. Each drupe is 2.5 cm. in length and 12 mm. in diameter. The leaves are made into straw from which coarse mats are woven.

Taboan is the name given to *Pandanus dubius* in Surigao while in Bohol it is known as bacong. It is a rare species. It is said to be a heavy, clumsy appearing tree with stem about 8 m. high, wide spreading branches near the top, and soft, pulpy and stringy wood. The flowers are grouped into an inflorescence. The male inflorescence, about 60 cm. long and partly covered by creamy yellow bracts, is erect and occurs at the end of the branches. The leaves are deep green in color on both sides, with an average length of 2.25 cm. and a width of 20 cm. The drupes of this pandan are from 8 cm. to 13 cm. long and from 5 cm. to 8 cm. wide. The plant is utilized to a small extent in making mats.

Plate XLV. Weaving a karagumoy mat, Tabaco, Albay.

In the Tagalog speaking provinces of Bulacan, Bataan, and in and around Manila, *Pandanus luzonensis* is called "alasas." It is also called "pandan" but this name should be reserved for *Pandanus tectorius*. The former is restricted in its habitat to the provinces around Manila Bay, while the latter is found in most of the seacoast provinces of the Philippines as well as in other tropical parts of the world. *Pandanus luzonensis* attains a greater height than *Pandanus tectorius*, but has narrower leaves than the latter. The male flowers are borne in a fleshy, much-branched inflorescence from 20 to 30 cm. long. Each

branch is partly surrounded by a broad thin bract, 8 cm. wide. Each individual flower has from 4 to 9 stamens. The whole fruit is about 20 centimeters long and contains from 30 to 60 drupes, yellowish red in color when ripe. Each drupe is from 3 to 4 cm. long, 2 to 2.5 cm. thick, and contains from 6 to 10 seeds. The straw from this pandan is of inferior quality, though it is said to be used in Bulacan for mats.

UNIDENTIFIED PANDANS.

Besides the pandans, the identity of which has been explained above, there are several unidentified specimens or varieties from which mats are made. It may be that some of these will be found identical with those already discussed when sufficient botanical material has been gathered to determine them.

In Isabela Province, a pandan known as "langu" having long, strong, thin leaves, is made into mats in Santa Maria, Delena and Bolasi.

Mats are made along the coast of Cagayan Province, in the Ilocano barrios of the towns of Claveria and Sanchez Mira, from a pandan known as "pataga." These are very coarse and thick and have an unusually shiny surface. According to Mr. Otto Harwood, the leaves vary in length from 10 cm. to 35.5 cm. and in width from 7.5 cm. to 15 cm. The straw is made by cutting the leaf into strips and drying them in the sun. Although the industry is yet small, it is developing.

A species of pandan is employed in the towns of Camalaniugan, Aparri, Gataran, and Lal-loc in Cagayan Province for making mats. Locally they are valued at from 40 to 50 centavos, but in Isabela Province to which they are exported they sell for as high as a peso and a half.

The only municipality in Pangasinan province in which the making of mats has reached provincial and interprovincial importance is Bolinao. The species of pandan employed is not known. The mats are shipped to towns along the seacoast of Ilocos and Zambales Province by sailing vessels, and are sold in the local markets or to local merchants.

In Mindoro the town of Subang makes pandan mats which are shipped to Batangas, Cavite, and Manila.

Two pandans, called lingo and baring were sent to the General Office of the Bureau of Education from Guindalman, Bohol. It was impossible to identify them as no fruit was included. They probably represent two new species. Lingo has a leaf 2.9 m. in length and of an almost uniform width of 5.5 cm. At 80 cm. from the tip, it is 4.5 cm. wide, then gradually becomes

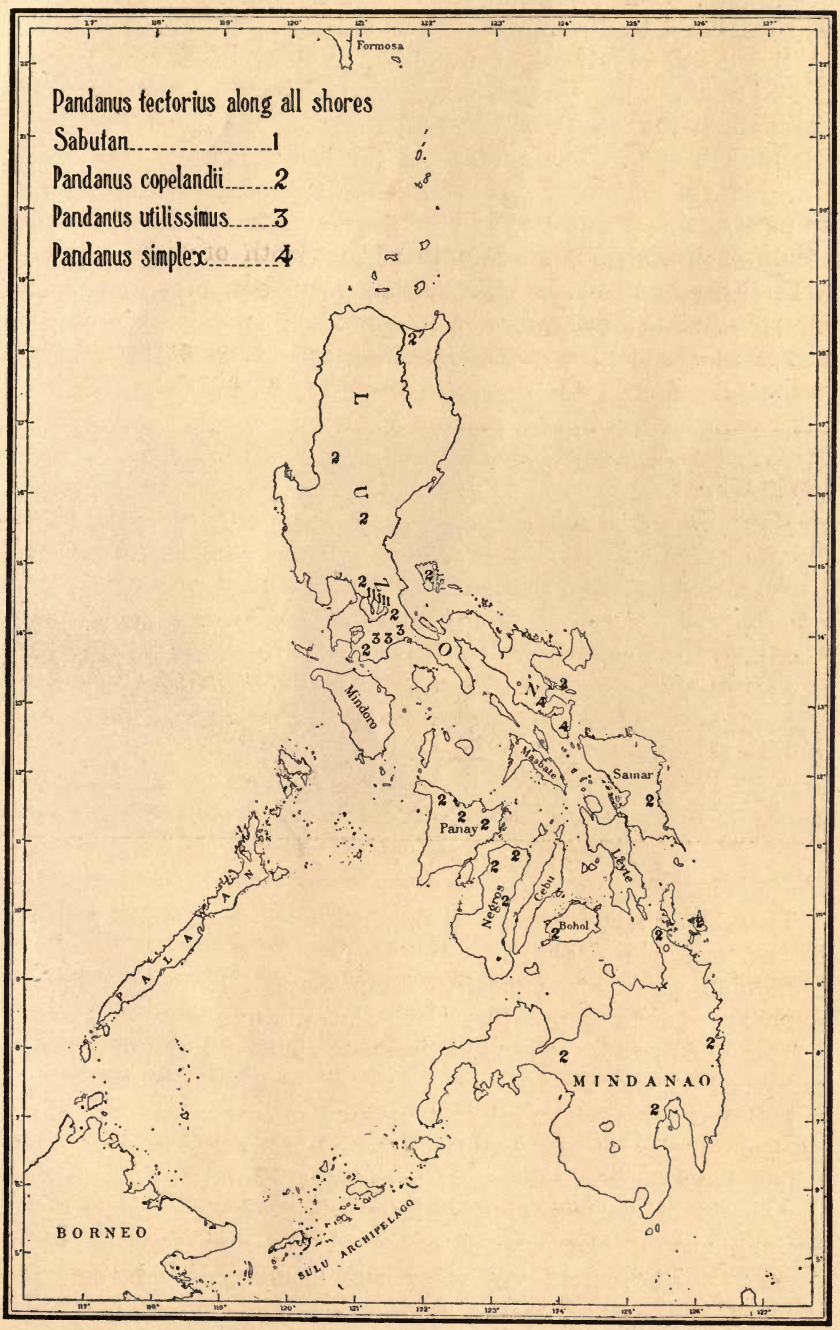

Plate XLVI. Philippine distribution of chief utilized pandans.

acuminate. The marginal spines are 2 mm. long, curved forward, from 6 to 8 mm. apart near the stem, but closer together at the distal one-third of the leaf. Spines of 1 mm. or less in length and 4 mm. or less apart, curved forward and extending throughout the length of the leaf, occur on the lower surface of the midrib only. The surface of the leaf is smooth and shiny. The leaf of baring is 72 cm. long, 2.8 cm. wide, apparently spineless, smooth and fine in texture. Both of these pandans would probably yield good industrial materials.

In Iloilo, the town of Banate has a pandan mat industry of interprovincial importance, whose product is an article of commerce as far as Negros. The mats sell at about 50 centavos each.

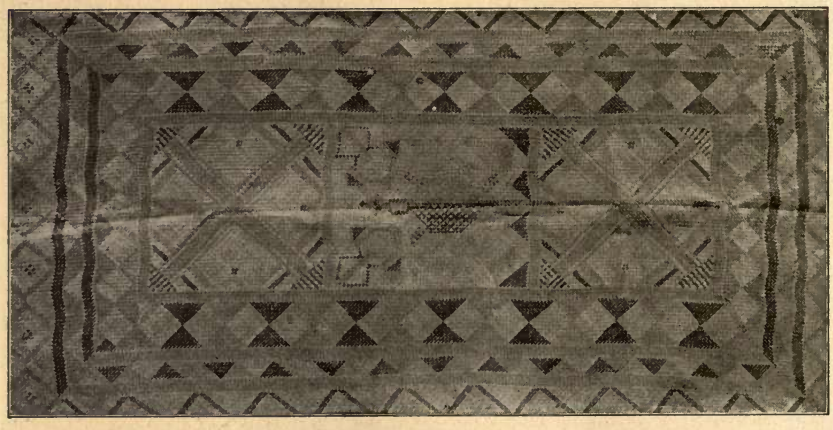

Plate XLVII. A Moro mat.

There is a large export of pandan mats from Dao, Antique, to the province of Iloilo.

Pandan mats are exported from Cuyo Island in Palawan. Some are sent to the mainland of Palawan and others to Antique.

The Moro pandan mats are the most richly colored of all those produced in the Philippines. At this writing, information is not at hand to determine the method of preparing the straw or the species of pandan from which they are made. Mats which have been exhibited at successive Philippine expositions have undoubtedly been dyed with imported coloring matter. The designs are of the general effect of the mat reproduced on page 84. The colors are often well combined and the effect is very striking. The Cottabato mats are double; the under portion is woven of thick, heavy, uncolored straw, and the upper portion is of finer material; the two parts are spliced together.

SEDGE STRAWS.

KINDS OF SEDGES.

BOTANICAL.

The sedges which form the family of *Cyperaceae* are grass-like or rush-like herbs, with solid, jointless, usually triangular stems, while the grasses (*Gramineae*) are mostly herbs, usually with hollow stems closed and enlarged at the nodes. The former play an important part in the manufacture of mats because of their length and freedom from nodes. The family includes several genera of importance; viz., *Scirpus, Cyperus,* and *Fimbristylis.*

Of these the *Fimbristylis* is the most important, for two species of *Fimbristylis* have a fairly large commercial use; they are therefore taken up separately.

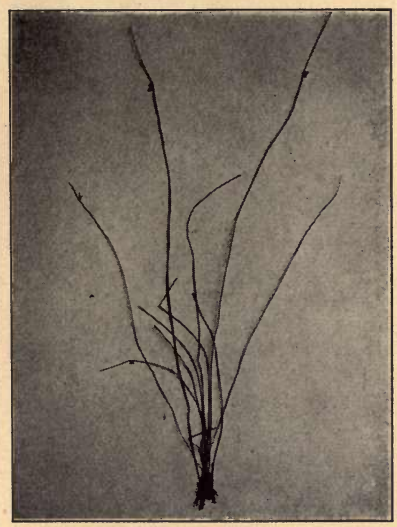

Plate XLVIII. Scirpus erectus.

Of the genus *Scirpus,* the species *S. grossus,* known as "balangot" in Ambos Camarines and Capiz, "bagaas" in Occidental Negros, "tiquio" in Rizal, and "bagui-bagui" in Capiz, and *S. erectus,* are used for mats. *S. grossus* is not a very suitable material for industrial purposes, its distinctly three-cornered stalk being too coarse in texture and too large to permit of weaving even a fair grade article. *S. erectus* is much better. The stalk is about as fine as tikug and grows to a height of 60 cm. The flowers sometimes occur in a solitary cluster, but more often from 2 to 5 clusters of spikelets are found on the side of the stalk near its top. The plant is widely distributed in the Philippines and inhabits open grass lands. It bears some flowers throughout the year. As yet only coarse mats are made from it, but its general appearance would warrant experiments along the lines of the processes by which tikug is treated. The only native names noted are "tayoc-tayoc" and "tikug" by which names the plant is known in Occidental Negros. These names, however, are more properly applied to other plants. *Scirpus mucronatus* is somewhat like *S. erectus* in general appearance. The stem of *S. mucronatus* is more robust and coarser in texture and attains a height of 80 cm. Its dried stem

has an average width of 4 to 5 mm., while that of *S. erectus* measures from 2 to 3 mm. The flowers of *S. mucronatus* appear in a very dense head on the side of the plant from 2 to 9 cm. from the top. Each head is made up of from 5 to 20 spikelets. These spikelets are from 6 to 15 mm. long, while those of *S. erectus* are never more than 1 cm. in length. The coarser stalk of *S. mucronatus* makes it a less desirable mat material than *S. erectus*. In the Ilocos provinces a very coarse round sedge called tiker (*Scirpus lacustris*) occurs. It may be of value if split and dried in the sun so that it curls up into a round straw.

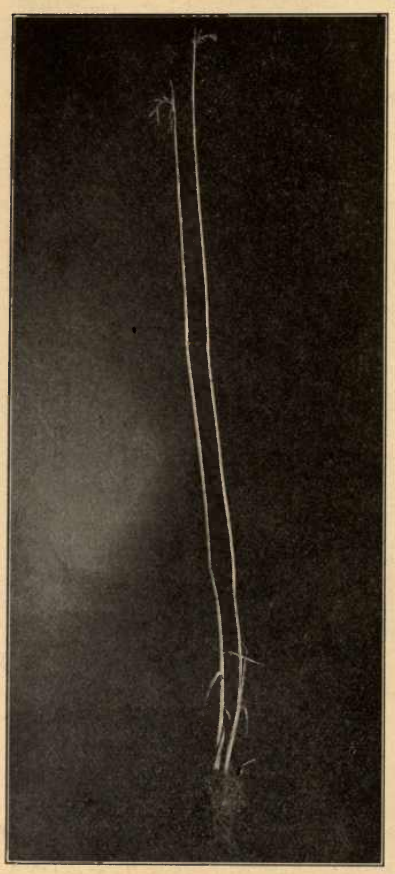

Plate XLIX. Tiker (Scirpus lacustris).

The genus *Cyperus* includes a number of economic plants, among them the Chinese matting sedge. The species most used in the Philippines is *C. malaccensis*. This plant has an underground stem which, as it continues its growth, sends out new stalks. The plant lives for a number of years and when fully grown is from 0.5 to 1.5 meters high. The stem is stout and three-sided in shape. It has few or no leaves, and when present the leaves are not more than 3 cm. long. From 2 to 5 leaf-like stems (bracts) not more than 20 cm. long occur under the inflorescence. The spikelets which make up the inflorescence are somewhat crowded together; they are very narrow, from 1 to 2 cm. long. The plant occurs in the Philippines in brackish swamps and along tidal streams. It is also found in tropical Africa, Asia, the islands of Polynesia, and Australia. It is usually in flower from July to December. It was formerly made into mats and hats and is even now utilized in rare instances in weaving them, but it is most important as a material for slippers, and possibly for matting.

Of the 125 species of *Fimbristylis* found only in warm regions, two are of economic importance in the Philippines, while one

more might perhaps be tried out as a mat material. All the species of *Fimbristylis* have tufted, fibrous or woody stems. The leaves occur near the base. The inflorescence consists of a great number of flowers grouped closely together to form one or more spikelets. The spikelets themselves may be either solitary or clustered. The individual flowers are covered by glumes and are arranged spirally on the axis. As the fruit matures, the glumes of the flowers become the "chaff" of the grain.

TIKUG.

This sedge (*Fimbristylis utilis*) grows usually more than a meter long and has tufted stems which are shiny and smooth in appearance and average about 4 mm. in diameter. The stems may have long leaves at the base or may be entirely leafless, and are usually four- or five-sided immediately under the inflorescence. The general appearance of the stalk is round. The plant has few or no underground root-like stems. The flowers are densely clustered together to form spikelets, dusky brown in color, measuring 6 mm. by 3 mm. In the Visayas it is generally known as tikug. In Agusan and Surigao it is called "anahiwan" and in Bukidnon "sudsud". Sometimes it is called tayoc-tayoc in confusion with the smaller sedge more properly known by that name, which much resembles tikug. A specimen from Pampanga was labeled "muta".

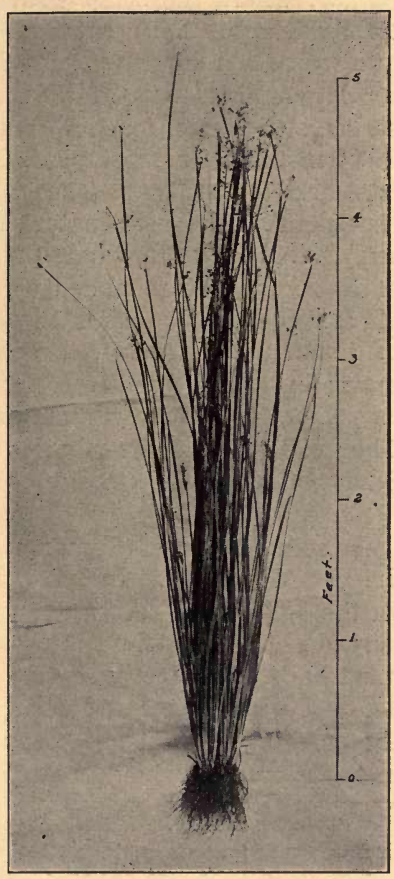

Plate L. Tikug.

Tikug grows in greatest profusion and reaches its highest economic importance in parts of Mindanao, Bohol, Leyte, and Samar. To a less degree, it is found and utilized on Negros and Panay. While it is found in Cebu, it is not used there. As a recognized industrial plant, therefore, its distribution is confined to the Visayas and Mindanao. Its appearance in Pampanga would indicate that it may be found in other regions in

which its value in hand-weaving and in the making of matting is not understood.[26]

Tikug is utilized in making hats, mats, matting, slippers and various minor articles.

Samar Mats.

GATHERING THE STRAW.

The best known tikug mats are produced on the Island of Samar, where the sedge grows wild.[27] It has never been cultivated there. Different grades are recognized in the height and width of the straw. The finest is 1½ mm. in diameter while the largest straws are fully four times that width. Full grown stalks sometimes reach 3 meters in height, but the average is 1½ meters. In most places in Samar only very coarse tikug is found and this is especially true in the northern half of the island. The best material grows near the towns of Basey and Sulat, a circumstance probably due to the fact that most of these sedges are pulled up for weaving before they become old and coarse, for it is in these two towns that the mat industry of Samar is centered. All grades of tikug can be used in making mats; but as the straw cannot be split into finer pieces, it is only from the narrower material that the fine mats are made. The map on the distribution of tikug shows the regions in Samar in which this sedge occurs.[28]

BLEACHING.

In some parts of Samar rough mats are made from tikug dried in the shade. In Basey and Sulat bleached straw is used. In the bleaching process only the sun is used, the bundles being spread out where there is neither grass nor shade. The straw must be kept perfectly dry at all times, for if it becomes wet or damp it will mildew and turn an unsightly black or brown. In the morning it must not be put out until the ground is dry and in the evening it should be taken in before dew is formed upon

[26] Robinson, in Vol. VI, No. 2, Section C of the Journal of Science, states that this sedge also grows on the eastern side of Luzon.

[27] *F. meliacea* is also known as tikug in Samar but it cannot be used in weaving.

[28] In pulling up tikug the whole stalk can generally be obtained by grasping it a short distance below the top. It is made into small bundles and tied a short distance below the seed heads. Each bundle contains from forty to sixty straws. In all towns except Basey the weavers gather the stalks they use. At Basey, however, where weaving of mats is a recognized industry, the straw is obtained from country people who make it a business to gather and sell it. These tikug vendors carry the bundles of green straw to the town, where they sell for from forty centavos to one peso per hundred bundles, depending upon the length of the straws.

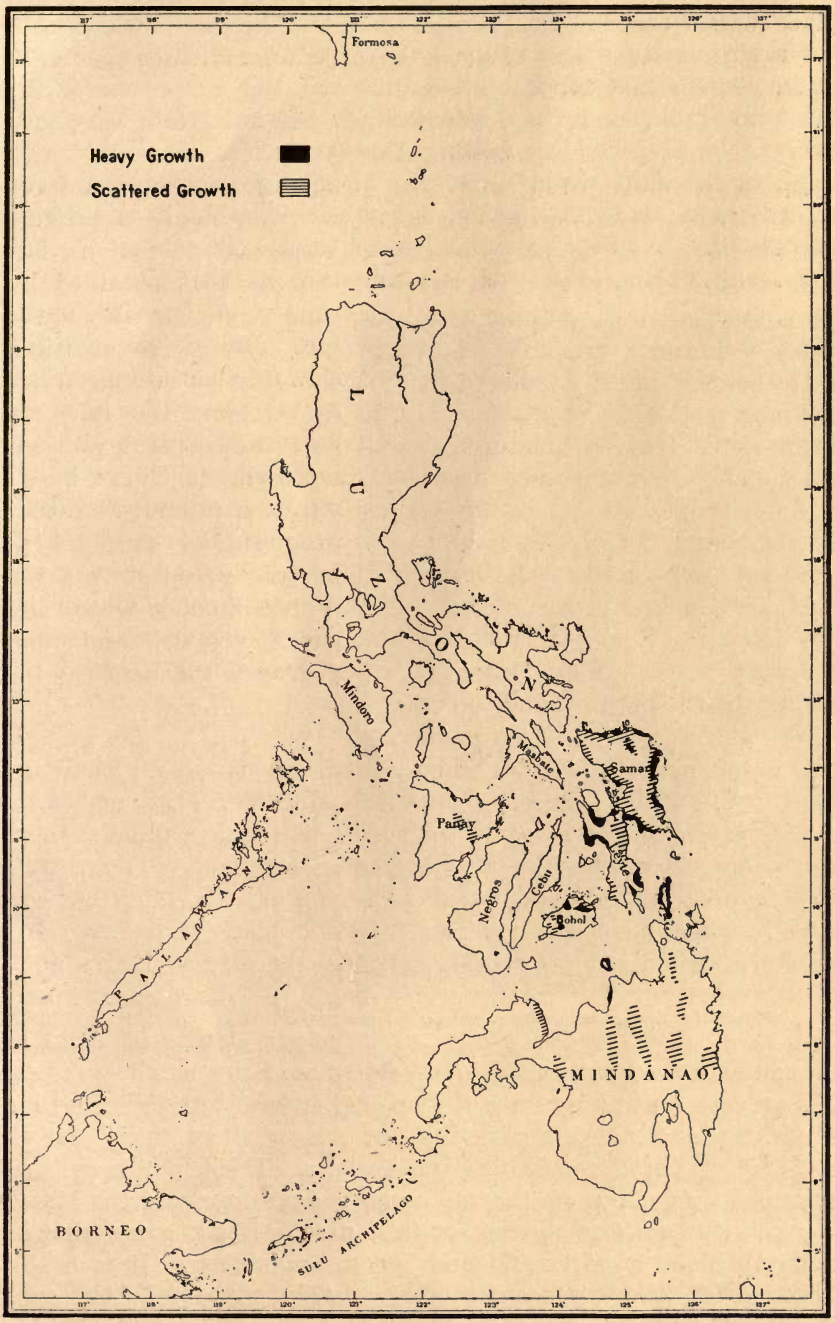

Plate LI. Philippine distribution of tikug.

it. The best results are obtained by drying the material in a place where there is no grass, as the turf generally holds considerable moisture and retards the process. With proper care clean white straw can be obtained in about one week under the most favorable conditions. Sometimes, but not often, the above process is preceded by boiling the straw for ten or twenty minutes in plain water. Several bleaching experiments have already been made with tikug, but as yet none has been entirely successful. In one experiment straw was boiled in alum, but the resultant material was not so white as that obtained by simply drying it in the sun. Boiling green tikug in water containing acetic acid from the juice of limes and lemons was unsatisfactory. The best straw obtained was that produced by simply boiling the green stalk for a few minutes in water and rinsing it well and then drying in the sunshine for several days.

Plate LII. Dyeing tikug, Basey, Samar.

The straws are of different lengths and diameters; after bleaching they must be sorted. The seed clusters are removed and the bunches are tied in a big bundle which is laid on the floor with root toward the worker. The longer straws of small diameter are then pulled out and placed in small bundles, the process continuing until the several different grades are thus separated and nothing remains but a few short thick straws which are kept for embroidering designs. Each bundle is then trimmed by cutting off the roots and ragged tops and the straw is ready for storing, dyeing, or flattening. If tikug remains in a damp place it will mold and become worthless. It is easily kept during the dry season, if frequently exposed to the sun. During the rainy season it should be wrapped in a blanket or cloth.

DYEING.

Very few uncolored straws are used in Samar mats. The dyed material is more durable and does not mildew as readily as the uncolored straws. Tikug dyes easily and this is probably one of the reasons why the mats of Samar have so much color. The cost of the dye in a Basey mat is no small part of the total expense of production. Consequently it is necessary to employ a cheap dye. For instance, one of the best commercial dyes known in Manila was used with great success on Samar mats, but the value of the coloring material consumed in making them was greater than their selling price. The dye used in making the cheapest of Samar mats costs the weavers about 10 centavos while the more elaborate products need as much as 65 centavos worth of dye to color them. A common mat containing 15 centavos worth of dyestuff sells for about a peso.[29]

The colors obtained by the Basey mat weavers have a greater variety of shades and tints than those produced by any other workers in the Philippines on tikug or any other mat material. The shades and tints depend upon two considerations: (1) The amount of dyestuffs used and (2) the length of time the boiling process is continued. Four dyestuffs are used. Yellows are obtained from turmeric; greens and reds are obtained from coal-tar dyes; and a red-orange from deora. The leaves of the latter plant are crushed and the pulpy mass thus obtained is boiled to yield the dye fluid. By combining these four dye materials in different proportions, by using varying amounts of the material, and by boiling varying lengths of time, different colors, shades and tints are obtained.

The method of dyeing is as follows: The bunches of tikug are coiled and placed in a can of hot dye, where they are boiled from two to ten minutes, or until the desired intensity has been secured. The more the straw is boiled, the more nearly permanent will be the color and the greater will be its intensity. Care must be taken to see that the dye fluid is not too strong; otherwise the color will be too intense. In order that the material may be evenly colored, the tikug is submerged in the dye so that it is well covered and is turned over several times during the process. After the coils are removed they should be laid upon the ground or floor, allowed to cool, and then hung in the shade to dry.

[29] The high cost of these dyes results from the adulteration practiced and the exorbitant profits, usually about 450 per cent. It is expected that the new dyes obtained from Germany through the Bureau of Education will make a saving of about 80 per cent to the workers.

FLATTENING.

The straws composing the bleached or dyed bundles of material are stiff and uneven; some are bent and others are round. The process of flattening them and making them more pliable is carried on during damp days, in the morning or evening, for if done in the open air on cloudless days, or at any time when the atmosphere is dry, the straw becomes brittle and breaks. However, climatic conditions may be overcome by wrapping the straw in banana leaves or damp cloth for an hour or more and then working it where no breeze can dry it out. No water should be applied. The workers employ the usual blunt-edged, ruler-like piece of wood; between this and the thumb the straw is drawn by the free hand. This process flattens the straw and makes it pliable so that it does not split during weaving.

THE WEAVING OF SAMAR MATS.

Up to three years ago tikug was but little used in Samar except for weaving mats. Commercially, mat weaving was confined to Sulat and Basey. Since the American occupation it has been widely done and the work has been introduced into most of the schools. Not only have methods been greatly improved but new uses have been found for the material. To-day the sedge is woven into floor and wall mats, hats, table mats, slippers, book-bags, hand-bags, necktie cases, pencil holders, pencil cases, and pillow and cushion covers. Recently the weaving of matting on looms has been undertaken in the schools and a fine product, similar to the matting of Japan, has been produced on the ordinary loom adjusted to the straw.

The chief use of tikug in Samar is in the weaving of mats in the towns of Basey and Sulat. Since time immemorial tikug mats have been woven in Samar. At Palapag, Oras, Dolores, Taft, Balangiga, Santa Rita, Gandara, Oquendo, and Catarman, a few rough ones, the product of unskilled workmen, were made, but they were of no commercial importance, since the people did not weave enough to supply their own demand. As far back as can now be traced, the people of Basey and Sulat have been making mats for the provincial and interprovincial trade. Since 1907 the people of Dolores, Oras, Santa Rita, and Balangiga have improved in weaving and are now producing a few mats for the market. Their work is much inferior to that of Basey and Sulat. In the year 1911 Basey produced about 9,000 mats and Sulat about 300. The latter town could have increased its production greatly, but its remoteness from the market and from the routes of commerce reduces the large demand which

might otherwise exist for the mats. Basey is better situated in these respects; moreover, the people have been forced to fall back on mat weaving as their chief means of support, for typhoons have destroyed their coconuts and abaca, and their rice crop is scant. Almost every night mat weavers are found at work in many of the houses.

Several years ago, when American soldiers were stationed in the vicinity of the town, there grew up a great demand for mats, and the weavers, taking advantage of their need and their little knowledge of values in the Philippines, demanded exorbitant prices and received them. Most of the Basey people spent their time producing mats, and to a great extent sacrificed quality for quantity. The grade of mat that sold for ₱18 several years ago

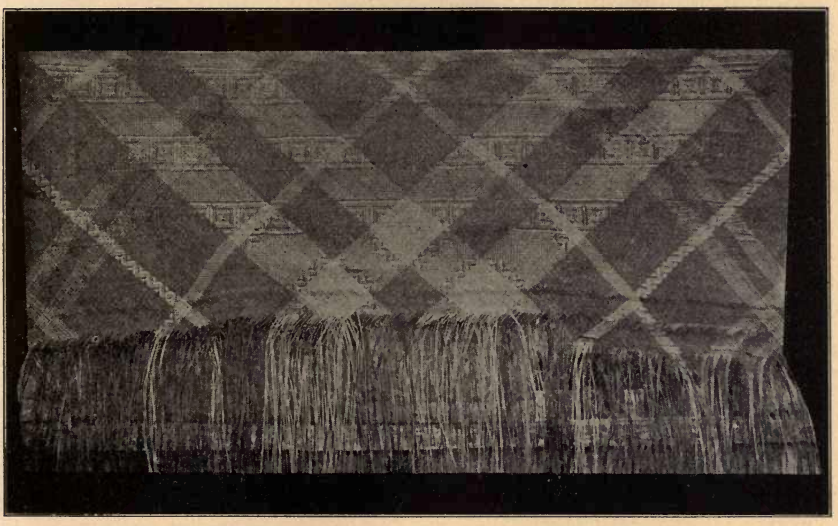

Plate LIII. Incomplete Samar mat of medium grade showing woven-in design.

can now be bought for about ₱8; that which sold for ₱3 two years ago can be bought to-day for ₱2. Lately there has been a rise in price owing to increased commercial demand. Mats made to order, particularly special mats, cost more than those bought already woven, the price depending upon the size of the article, the character of the design, and the fineness of the straw and the weave. A mat two meters by one meter, made of the finest grade of tikug, would require several months for completion and would probably cost between ₱30 and ₱40. There is hardly a limit to the size of the mat which can be woven. Three years ago one having dimensions of 10 meters by 12 meters was made for a church, as many as 30 women working on it at the same time.

Basey mats are of two general kinds: those with plaid designs woven in and those on which the designs are embroidered. The former are the more difficult to weave; but as there is no decoration to be added, they are the cheapest mats obtainable, the prices for the ordinary grades ranging from ₱0.80 to ₱3 each. Some weavers turn out only blank mats of one color and do neither designing nor decorating. Straw used on these is usually dyed, very few mats of natural colors being made. They are worth from ₱0.50 to ₱2 each and are generally sold to girls who are skillful in embroidering designs. These girls decorate the mats and sell them for from ₱2.50 to ₱6 each, the price depending upon the original cost of the mat and the amount of decoration put upon it. The ideas for the designs on Basey mats are usually

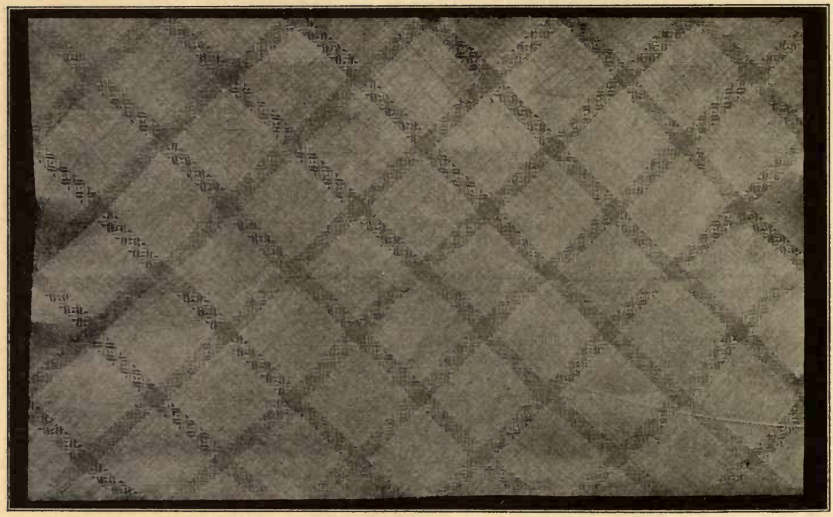

Plate LIV. A cheap Samar mat with woven-in design.

obtained from pictures or textiles. The straws, both bleached and dyed, are split in two for embroidering purposes. This makes them thinner and more pliable.

The time necessary for making a plaid mat sold for two pesos was found to be as follows, an eight-hour day being used as the basis of a day's work:

	Days.
Gathering tikug	1.00
Dyeing tikug	.25
Flattening tikug	.25
Weaving mat	3.50
Total time	5.00

The selling price of the mat was one peso, the cost of the dye 15 centavos, which left the weaver a balance of 85 centavos for

five days' labor. The plaids used in Basey mats are simple, but the embroidered designs are extremely intricate. They consist for the most part of foliage, flowers, and animals. Weavers are often given a contract to make a stated number of mats in accordance with a design furnished them. A few are capable of reproducing almost any pattern presented,[30] but if they are not told exactly what colors to use they employ every shade, color and tint they can secure. The Basey mats are distinguished by the multitude of colors used. In general it may be stated that the chief criticism of this product is the gaudy effect produced by the colors used. In some cases the colors are well toned and harmoniously combined, but the majority of the mats produced contain vivid colors which are not all harmonious. Through the

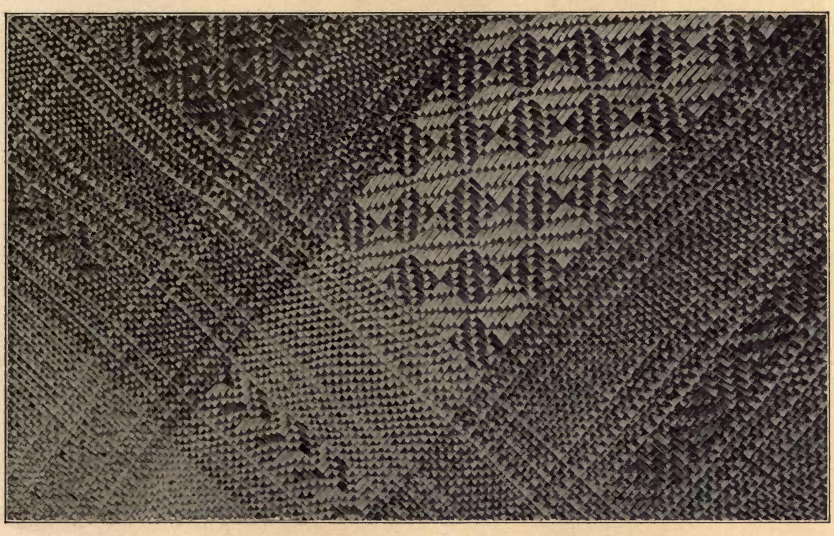

Plate LV. Detail of a woven-in design.

schools, efforts have been made to reduce the number of colors and to modify the gaudy and complicated floral designs. An improvement is seen each year.

The ordinary mat is usually about 2 meters by 1½ meters, though smaller and larger ones are made. During the past three

[30] The following story is reported as showing the cleverness of the weavers of Basey in embroidering designs on mats. An engineer in charge of road construction refused to buy certain mats from a vendor but stated, jokingly, and in order to be rid of the insistent merchant, that if he were brought mats having designs which were of interest to him, as showing scenes connected with his work, he would buy them. In a few weeks the broker returned, bringing with him a large mat on which were displayed a road roller, wheel barrows, shovels, spades and other implements connected with road building, and part of a road itself.

years the weavers have been encouraged to make mats about the size of an ordinary cot and to use no more than two colors in weaving them. A few mats suitable for placing under dining tables are also made.

Sulat weavers produce fewer mats than those of Basey but make them of fine, closely woven straw. Most of the mats with a woven-on border come from Sulat. These people, while able to produce a fine, soft, pliable mat, can not embroider decorations on them nearly so well as do the people of Basey.

Samar mats wear well. Wall mats last indefinitely and sleeping mats are used from two to ten years or more.[31]

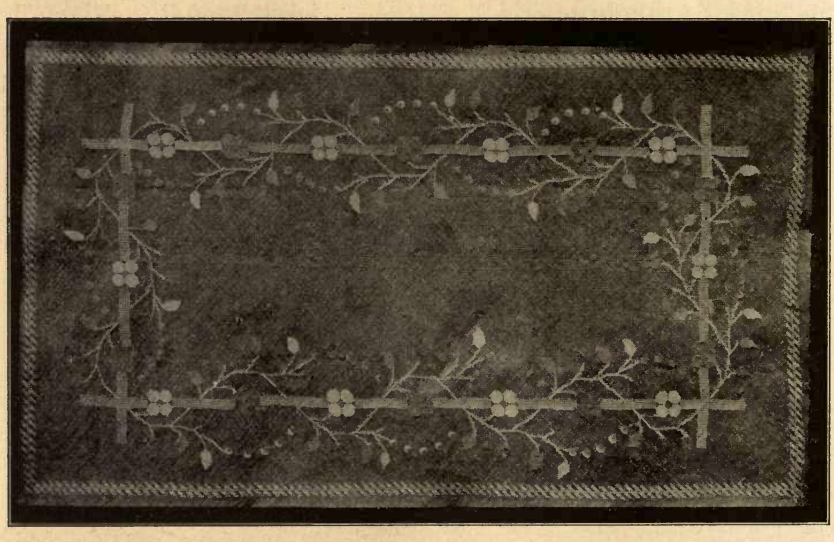

Plate LVI. An embroidered mat with simple decorations in comparison with most mats from Basey.

THE MARKETING OF BASEY MATS.

The port of Tacloban, Leyte, due to its proximity to Basey, is the chief center for the distribution of Samar mats. As soon as the mats are completed the weavers take them across the straits to Tacloban, where they are sold to Chinese brokers, transients and residents, both American and native. Few ships leave

[31] In general it may be stated that the sabutan and tikug mats are the strongest made in the Philippines. Neither the wearing qualities of the straw nor the permanency of the dyes in buri mats are equal to those of tikug. If tikug floor mats become dirty they may be cleaned without injury if the dyeing was well done. They should be shaken to remove dust and dirt, laid flat on the floor and lightly scrubbed with a cloth, sponge or brush, using lukewarm soapsuds, after which cold water should be thrown on them. They are dried by hanging in the sunshine or the breeze.

Tacloban that do not carry away from 5 to 20 mats; often they take away as many as 50, the amount generally depending upon the number of passengers aboard the boat. Some of the ship's employees are regular customers of the weavers and buy mats at stated prices to sell them again at a reasonable profit at Manila and other ports of call. Besides, there is quite a sale of mats in the towns of Samar, Leyte, and Cebu through vendors, residents of Basey, who secure the mats in their home town at low prices and sell them at a profit. These persons usually deal only in the mats, and sell them for cash, not trading for other articles. Plaid Basey mats are on sale in nearly all the Chinese general merchandise stores of Manila.

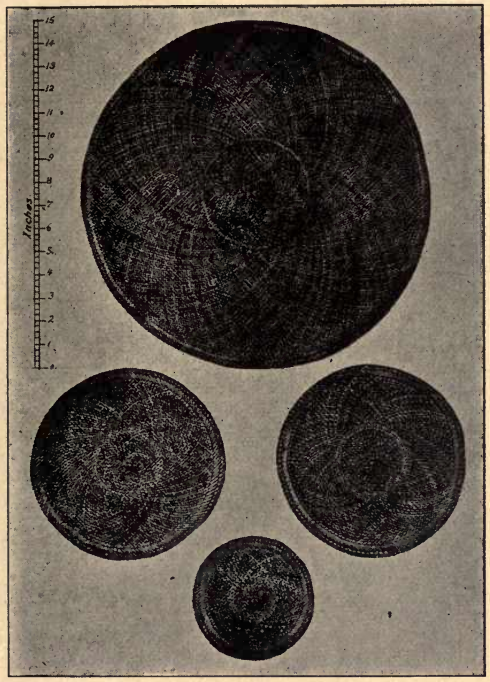

Plate LVII. Small table mats.

As yet there is little supervision by brokers in Basey. The mat industry there needs but the introduction of some system of supervision by brokers to regulate the size, quality, design and color scheme of the mats, and a foreign market to become a much more extended industry. The schools have already done much toward improving workmanship and design; it must remain for individual enterprise, however, to get in touch with foreign demand and supervise the weaving of mats to suit it.[32]

Bohol Mats.[33]

Tikug mats are made in large numbers in Bohol. The straw for the most part is finer than that used in Samar and the pat-

[32] A firm has recently entered the field and is doing a mail order business in these mats with the United States. Their plans include the furnishing of straw and dyes to the weavers and the weaving of standard designs.

[33] Most of the information given under this heading was taken from reports by Percy M. Jones and Frank Thomason, formerly supervising teachers of Bohol.

terns are chiefly stripes and checks. Very little embroidering is attempted.

Bohol mats are used principally for sleeping purposes. In northern Bohol there is scarcely a family that has not three or more large mats, which are rolled up and laid away during the day time and are unrolled upon the floor at night for a bed. They are durable and last for years. Large sleeping mats may be purchased in quantities as high as 40 to 100 during the Sunday market day in Talibon or on the Saturday market day in Ypil, a barrio of the same town. In price they range from one to three pesos each.

The second use of Bohol mats is for decorating walls, tables, and floors. Those so employed are smaller than the sleeping

Plate LVIII. Embroidering a mat.

mats, usually square, but sometimes round. More care is exercised in their weaving and only fine young straws are used. The preparation of the straw and the dyeing are done with great care. Mats of the best quality are quite difficult to secure and the schools have recently been encouraging their production.

As in other regions, the tikug from which Bohol mats are made, grows wild in the rice fields after the harvest. It is found in abundance in northern Bohol in the municipalities of Getafe, Talibon and Ubay, and sparingly in other towns of the island (see map). The straws are gathered from the field by pulling them, thus breaking them off at the roots, and they are tied into bundles about 3 decimeters in circumference and sold in the market. The largest market for such bundles is found in

the barrio of Ypil in the municipality of Talibon. The price is usually about 10 centavos per bundle. From two to four of these bundles are required to make a mat.

The tikug is not kept in the original bundles longer than one or two days, for it will turn black. The material is usually separated into two parts, one to be dyed, the other to be bleached. That to be dyed is spread in the sun and thoroughly dried for one or two days, care being taken that rain does not fall upon it and blacken it. The other part is boiled in a solution of acetic acid for twenty minutes, after which it is thoroughly dried in the sun and thus bleached.

The natural dyes used in Bohol for coloring tikug are dauda and turmeric. The former produces permanent colors, the latter fugitive ones. The artificial dyes bought at Chinese stores are also used in producing shades and tints of green, violet and ruby which are satisfactory. In general, those in crystal form have proven more satisfactory than the powder dyes. Before dyeing, the sheath-like leaf is pulled from the bottom of each straw and the material is looped into small bundles. Often the straws are dampened with water. Dyeing is usually done in a 5-gallon petroleum can two-thirds full of water, heated to boiling. If the artificial dyes are used the powder is stirred in and dissolved and the bundles of tikug are then pressed down into the liquid so that all the material is well covered. A stone is often laid upon the straws so as to keep them down in the boiling dye. It usually requires about twenty minutes to obtain the desired shade, which is nearly always a deep one. Where fresh dauda leaves are employed, about 2 pounds are placed in the water and boiled a few minutes before the tikug is put in. If dried leaves are used about one pound is soaked in cold water for a few minutes and the whole mass is then added to the boiling water. Turmeric roots are pounded in a mortar and then added to the boiling water, after which the tikug is added. All the dyes noted are combined to produce other colors and varying shades.

During the process of dyeing, the straw should be turned and moved about in the boiling water to insure an even color. The straw should never be boiled too long, or it will be cooked and become tender and weak. After the straw has taken on the shade desired, it is removed from the can and thrown on the ground. When the bundles are cool enough to be handled, they are untied and the straws spread out to dry, preferably in the shade. After it is thoroughly dried the material is rebundled and thus kept for weaving.

Before weaving, the straws are flattened by drawing each one separately between the edge of the knife and the heel of the weaver's foot or the sole of the chinela. Damp days are best for this process. Weaving is done under the house or under trees. Evenings and nights are most suitable for this work on account of the dampness of the atmosphere. The embroidered mats of Bohol are decorated with split straws.

The mats of Bohol are bought by traders who exchange cloth and other goods for them. These men carry them to the towns of Bohol which do not produce mats, and to other islands, where they sell or exchange them at a good profit. When once the supply of mats on hand has been bought up in a mat producing town, several months elapse before the market there is replenished by a new supply. After completing a mat, the weaver has no immediate desire to begin another. It is quite probable that the output of mats could be increased considerably if the market and the price were better. It is estimated that the weavers earn not more than 20 centavos per day at the industry.

Other Tikug Mats.

Tikug also grows in large quantities in Leyte. Its chief use there is in the weaving of matting on a crude loom, an adaptation of the common textile loom.

Tikug is apparently generally used throughout Surigao in making mats. The best mats of this region come from the upper Agusan and the island of Dinagat. They are usually made for local consumption, though the people of Dinagat exchange their mats with Bohol traders. The sedge grows in great abundance in the lake of Talacogon near the town of the same name in Agusan.

Tikug is also found in many parts of the Moro Province. It abounds in the swamp lands of the Lanao region, from which mats are exported via Iligan. If it is to be colored, the straws are soaked in water for about two days, after which they are cooked in the boiling dye. Bleached straw is prepared by exposing it to the sun, after which the material is polished and flattened at the same time by rubbing the stalks with ashes, between the fingers.

The Cultivation of Tikug.

The question of the cultivation of tikug is one of considerable importance. It is a well known fact that the finest Leghorn hat straw is produced in Italy by sewing wheat closely and reaping the straw before the grain ripens. The best mat straws of China and Japan are produced from cultivated sedges. The

Bureau of Education is therefore encouraging experiments in the cultivation of tikug, but as yet these have not been extensive enough to determine whether the sedge can be propagated for industrial purposes. There are no data as to cost. A quantity of seed was procured and forwarded to various parts of the Islands in which tikug had not been reported as growing. These were sent out to various persons with the idea of determining (1) soils suitable to the plant, (2) whether it could be cultivated in the rice paddies between harvest and planting, (3) how closely the seeds should be planted, (4) how old the plants should be at harvest.[34] No results have as yet been obtained from the seeds so sent out. Fair results, however, have been realized in Samar, where approximately 5,000 stalks were grown to the square foot in very rich soil fertilized with manure secured from the military stables. The straws obtained were 3 meters long. It was found that the thicker the seeds are planted the finer and longer are the straws obtained.

Reports differ as to whether tikug should be considered a pest or not. In Leyte it is stated that it grows in the rice fields along with the rice crop and appreciably diminishes the crop. There it is a weed pest; in Samar it is not so considered. In Bohol one teacher states that the plant is not a pest as it will not grow in dry localities, and hence does not interfere with crops. Where it is found in the rice paddies, a covering of earth will easily destroy it. It does not scatter quickly, for, while the roots will grow if transplanted, the sedge is mostly propagated by seeds and these are distributed principally by water and not by wind. No great chances are taken in planting tikug. On the other hand, some teachers state that the seeds are scattered by the wind and that the roots impede the plowing of the fields.

It is probable that where the tikug obtains a good foothold on irrigated rice land it proves a considerable annoyance to farmers; but its growth as a pest can be regulated by plowing.

TAYOC-TAYOC.

This plant, *F. diphylla,* one of the most widely distributed of all sedges, is found at all altitudes up to 2,000 meters throughout the warm regions of the world. The stems may be smooth or hairy and the leaves one-third to two-thirds as long as the stem. *F. diphylla* is generally smaller than *F. utilis.* Its stem is only 2 mm. in diameter. The flowers, densely clustered into spikelets, are generally of two colors—straw and brown. They reach 1

[34] Circular No. 82, s. 1911, Bureau of Education.

cm. in length and 4 mm. in diameter. Below the spikelet the stem has from 3 to 5 sides. The roots are fibrous; underground stems may occur, but they are never more than 2.5 cm. long.

This plant is known as tayoc-tayoc in Iloilo, Capiz, and Occidental Negros. It is reported from Pampanga and is called "tabtabin" in Zambales.

The straw produced by tayoc-tayoc is much finer but considerably stiffer than that from tikug, and cannot be considered so good an industrial material. Nevertheless, it is used to some extent in the production of hats and mats, especially in the provinces of Iloilo and Capiz. In Dumalag, Capiz Province, hats are of considerable importance. Mats of tayoc-tayoc are reported as made in Banate and Janiuay, Iloilo Province, but this has not yet been verified.

As with tikug, seeds of tayoc-tayoc were obtained and distributed among various provinces to determine whether the propagation of the straw was practicable and if the cultivation of the plant would result in a better material. As yet no definite results have been obtained.

A RUSH STRAW.

But one rush straw has been brought to the attention of the Bureau of Education; it is the Japanese matting rush, *Juncus effusus*. This species is distributed over a large part of the globe, being the candle rush of Europe and the common plant of wet ground in the United States. In Japan it is made into beautiful mattings, the handsomest and most costly produced. The pith is also employed for lamp wicks, and probably the "timsim" imported from China and used in oil lamps in the Philippines is obtained from this plant. *Juncus effusus* has no native name in the Philippines. It is found throughout the Mountain Province and in the Apo region of Mindanao. It attains a height of almost 2 meters where soil and moisture conditions are favorable. The stalk is cylindrical and at the end tapers to a point. It is from 2 to 3 mm. in diameter. The flowers grow in a bunch on the side of the stalk near the top and are light brown in color. At the present time this rush is not utilized in the Philippines, though it is probable that it can be used in the weaving of many articles. If split, a flat straw is obtained by removing the pith.

PHILIPPINE MATS

PART III

[Reprinted from The Philippine Craftsman, Vol. I, No. 5.]

PHILIPPINE MATS.

EMBROIDERED MAT DESIGNS.[1]

It is better not to decorate a mat at all than to have the design ill fitting. Design is the pleasing arrangement of all spaces unfilled as well as filled. Decoration is for beauty wholly. If all the spaces are not well arranged, the design is not beautiful. If the design is startling or gaudy in color, it is not beautiful. If the arrangement of colors is inharmonious, the design is not beautiful. All mats cannot be in the same proportion and suitable for all designs. Plate LXV, for instance, shows a long design; it requires a long mat, and would not look well on a square one.

All mats here considered are about $\frac{1}{8}$ inch to $\frac{1}{4}$ inch in width of straw. Some of the designs are used exactly as they are, counting a straw for a square which represents a straw in the design; the others are double in size and contain four times as many squares in the weave as in the design. In such cases twice the count of the design will always give the right number for the weave.

In circular mats the directions are given in inches. The sizes of the mats should be taken into consideration, but a variance of a few inches will not matter if that variance always makes the mat larger rather than smaller. In these mats more is left to the judgment of the weaver than in rectangular mats. Designs should never be crowded on circular mats. Repeated groups should always be made exactly alike.

In the color notes, a series of colors set off by commas indicates that each series may be used alone for the whole design. Often the deep colors, especially No. 1, have been left out, as the effect of a very dark color on a very light mat is often startling. Designs on mats or hangings should not be more conspicuous than the mat itself, but should rather present a complete and harmonious appearance when both mat and design are considered as a whole.

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[1] Based on original designs by Mrs. Alice Brezina.

CIRCULAR MATS.

DESIGN A.

The straws of a circular mat cannot be counted and then divided equally by numbers, as straws are continually added at irregular intervals as the circumference is being reached. Hence, the only way to place designs on a mat of this kind is by dividing the whole mat with a diameter through its center.

Plate LIX. Circular mat, Design A.

Fold the mat and make a crease at the edges or mark a diameter through it with a pencil; at right angles to this diameter draw another through the same center, and the mat will now be divided into equal quadrants. The quadrants may again be divided and subdivided, and marked by pencil or with strings.

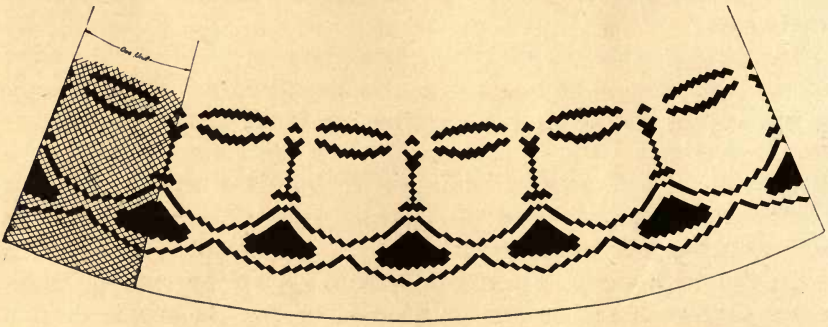

Plate LX. Circular mat, Design B.

In Design A the mat is about 57 inches in diameter. In a mat of this size there would be 48 units in the circle with a margin of $1\frac{1}{2}$ inches from the outer edge of the outer border line to the circumference of the mat. Divide the mat into halves, quarters, eighths, and sixteenths, and measure with strings. Each sixteenth contains three units. Divide this space into three equal parts.

Now embroider in each third one exact unit. In weaving in the unit, always commence on its outer edge; then if any slight variation of space has occurred, the irregularity will not be noticeable, as it will be in the line work of the unit, and not in its solid part. Each unit made in working as suggested from the outer edge inward will begin the other half of a solid figure already commenced. Notice the part of the design which has been marked off as one unit, and adhere to that arrangement.

This design may be placed on a mat 57 inches in diameter, or 114 inches in diameter making each figure with twice as many straws as in the first.

In ticug mats of natural straw, this design may be done in the following colors:

No. 2, 3, 6, 9, 10, 12, 15, or 16. (12 and 16 should not be used on sabutan.)

No. 14, with a solid diamond and outer border line in No. 3.

No. 3, 6, 9, or 10, with outer border line extending to edge of mat.

DESIGN B.

In Design B, the mat should be 56 inches in diameter. In each sixteenth of the mat, as in Design A, three units can be spaced. Note the unit marked off in the design and use only this unit; weave its two outer solid parts first, with the irregularities of space occurring in the open part of the unit.[2]

Mats woven for this design should be 56 or 112 inches in diameter. In mats of the latter size the numbers of straws are all doubled.

In mats of natural straw, the following colors may be used:

No. 2, 3, 6, 10, 15, or 16. (16 should not be used on sabutan.)

CIRCULAR FISH DESIGN.

This design calls for the division of a circular mat into sixths or twelfths, according to the size of the mat. The diameters of mats for this design may be, 244 (about 4 feet); 304 (5 feet); 335 (6 feet); and 366 straws (7 feet). To divide a circle into sixths, mark off the circumference into distances equal to $\frac{1}{2}$ of the diameter.

In a mat of 244 straws diameter, make the outside border line one inch from the edges of the mat. About 9 inches inside of the outer border line, weave another border line one-half inch

[2] Three units will take up about 3 times 17, or 51 straws. In starting, a curved pattern 51 straws across will have to be made and slipped up or down in a sixteenth division of the mat in order that the margin space may be determined.

wide. Midway between these two border lines, measure and mark the space for the center fish, making it 30 counts long, 20 on the left and 10 on the right of the dividing line.

Measure spaces on the other five dividing lines to locate the central fish of each group. After weaving these central fish, go back to the first group, estimate and mark the place for the upper fish and the lower fish, and weave them, making each of the same size and proportion as the central fish, as shown in the design.

In mat 304, as noted above, the border lines and all the fish are the same size as in mat 244.

In mat 335 all measurements are the same as in the above

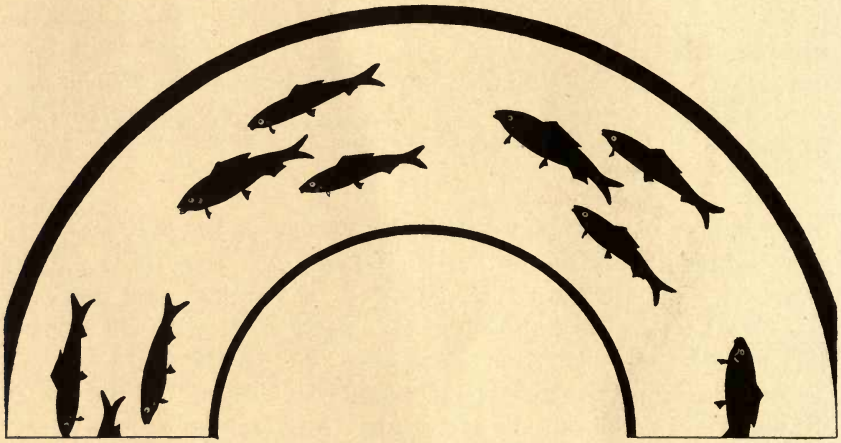

Plate LXI. Circular fish design.

mats, except that the circle is divided into twelfths instead of sixths, making twice as many groups of fish.

In mat 366 the outer border line is 2 inches from the edge of the mat instead of 1 inch and is 1½ inches thick. The other measurements are the same as in mat 335.

In mats of natural straw, the following colors may be used: No. 2, 3, 6, 10, 12, or 15. (12 should not be used on sabutan.)

GECKO DESIGN.

Mats woven for this design should be of the following diameters: 304 (5 feet); 335 (6 feet); 366 straws (7 feet).

Divide the circle into sixths, then into twelfths. Weave a border band on the edge of the mat ¾ inch wide. This band is not in the design but will come outside, and reach to the circumference line in the design. Down one of the twelve dividing lines, inside the border band, measure off 3½ inches and

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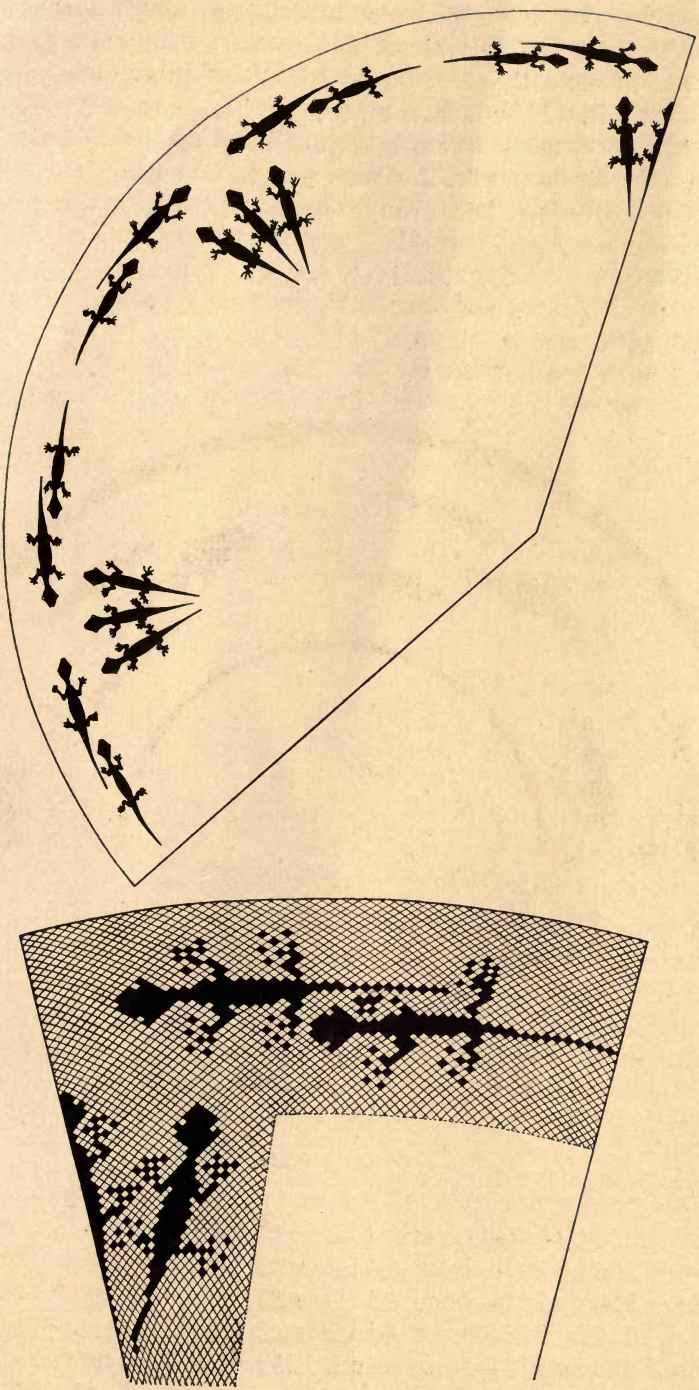

Plate LXII. Gecko design.

weave a gecko, half on one side and half on the other side of the line, extending the tail about 5½ inches toward the center of the mat. Weave the two on each side of this gecko, and the four above it. Now space and weave the other five groups. Each group contains seven figures.

The only difference in the larger mats will be in the spacing between the tails. The groups should be spaced the same as before.

In ticug mats of natural straw, the following colors may be used:

No. 1 with band of No. 3.

No. 1 with band of No. 9.

No. 12 with band of No. 15. (No. 3 should not be used on sabutan.)

No. (singly) 2, 3, 6, 9, 10, or 15.

GEOMETRIC DESIGN F.

The distance from A (the corner of the mat) to B is 12 straws;
from B to C is 2;
from C to D is 18;
from D to E is 29;
from D to H is 16;
from H to I is 32;
from E to F is 19; and
from F to G is 5.

Count from A to B. Weave from B to C and on around the entire mat.

Count from C to D and weave corner D H J E L. Weave all of the four corner designs exactly like D H J E L. Count from E to F and weave the two inner border lines around the entire mat.

Now count from H to I and mark similar points across one side. Weave from H to I. Weave from I to the next point (32 counts distant) the exact design between H and I. Weave at each point marked. Complete all four sides in a similar manner.

Mats woven for this design should be made in the following sizes:

310 by 534—from A to B is 34 straws;
266 by 394—from A to B is 22;
512 by 704—from A to B is 12;
320 by 512—from A to B is 12 (double count);
320 by 576—from A to B is 12 (double count).

In the last two sizes make the design twice as large as the

count; that is, A B should be 24, B C should be 4, C D should be 36, etc.

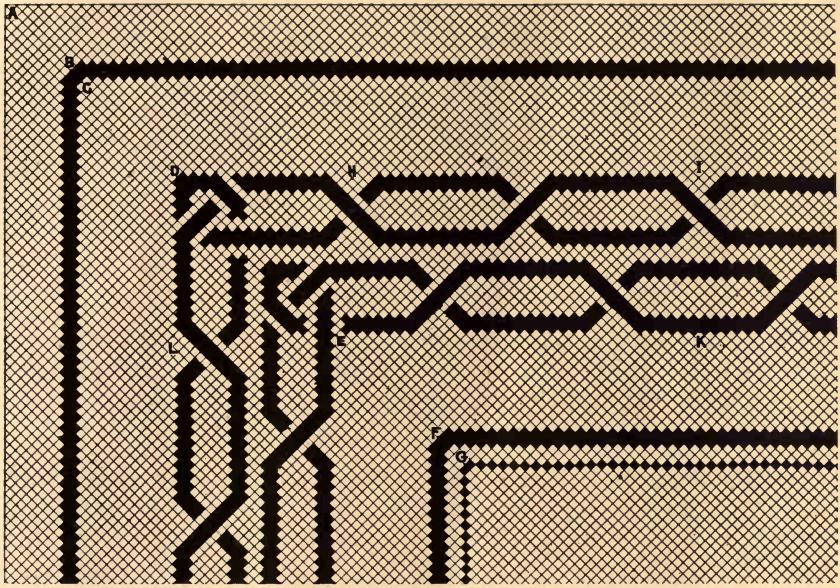

Plate LXIII. Geometric Design F.

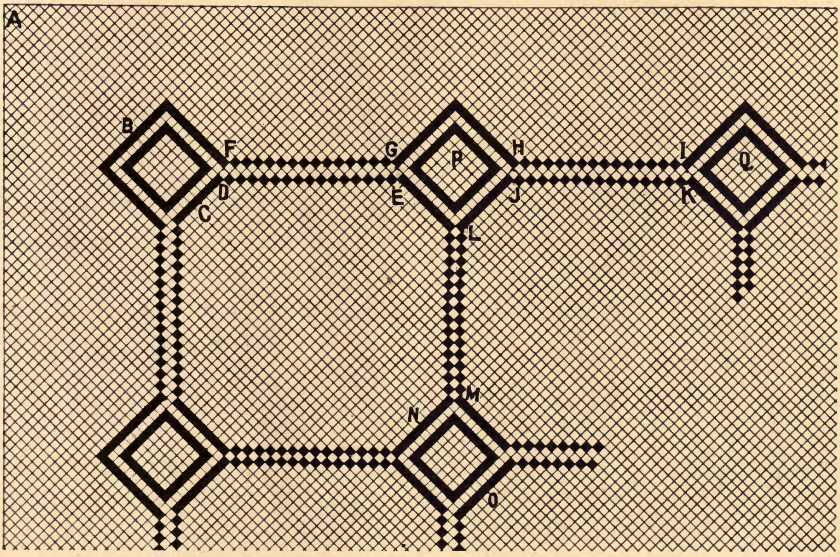

Plate LXIV. Geometric Design V.

In mats of natural color straw, the following colors may be used:

No. 2, 3, 6, 9, 10, 12, 15, or 16, each alone. (12 and 16 should not be used on sabutan.)

GEOMETRIC DESIGN V.

The distance from the corner of the mat A to B is 22 straws;
from B to C is 12;
from C to D is 4;
from D to F is 2;
from D to E is 15;
from F to G is 15;
from L to M is 14;
from C to N is 38;
from N to O is 12;
from F to P is 20; and
from P to Q is 25.

Count from A to B. At B weave the corner double square and continue on at FD to GE. Now weave the double square G H J E. Next weave the double squares in all four corners of the mat.

Now count from P to Q and mark. In the same way mark all the centers of the squares along the outer border line from corner to corner. Weave these squares, then the lines joining them. Weave down from L to M and continue the design on the inner border line, making double lines like L M as the weaving progresses.

Mats woven for this design should be of the following sizes:
228 by 378—from A to B is 22 straws;
253 by 403—from A to B is 22 straws;
311 by 536—from A to B is 30 straws;
536 by 686—from A to B is 30 straws.

In straw mats of natural color, the following colors may be used:

No. 2, 3, 6, 10, or 15.

GEOMETRIC DESIGN X.

The distance from A (corner of mat) to B is 22 straws (counting the fold at A);
from B to C is 8;
from C to D is 5;
from D to E is 4;
from E to F is 20;
from F to G is 4;
from G to H is 3;
from H to I is 6; and
from J to L is 52.

Count from A to B and weave border line around the entire

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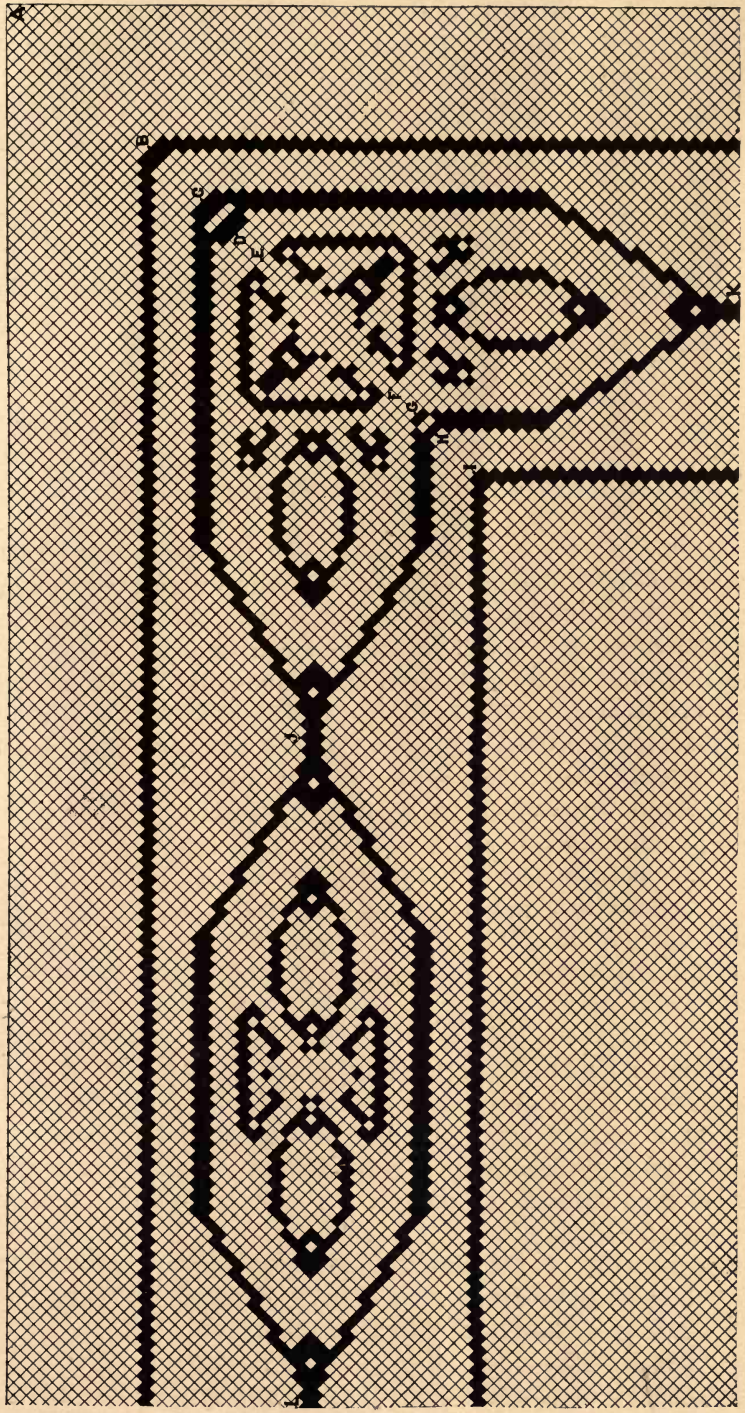

Plate LXV. Geometric Design X.

mat. Count from B to C and weave C D and over to J, back to H, over to K and back to C. Weave inner part of corner design. Weave inner border line at I entirely around the mat. Weave all four corner designs. Mark off J L, and L M, and M N, etc., until the corner is reached, making L M, M N, etc., each equal to J L. Weave all designs on side now spaced off. Space off and mark each side of the mat, before weaving. Weave all sides, completing the mat.

Mats woven for this design should be in the following sizes:

269 by 425;
321 by 529;
425 by 685;
165 by 425.

In mats of uncolored straw, the following colors may be used:

No. 2, 3, 6, 9, 12, 15, or 16. (12 and 16 should not be used on sabutan.)

GEOMETRIC DESIGN Z.

The distance from the corner A to B is 12 straws;
from B to C is 3;
from C to D is 16;
from D to E is 8;
from E to F is 26;
from F to G is 17;
from G to H is 4;
from D to K is 17;
from K to L is 12;
from L to M is 17; and
from I to J is 29.

Count down from A to B and weave the border lines B C around the entire mat. Count from C to D and weave the outer square of the corner figure. Complete the corner figure to I and N. Count from F to G and weave G H around the entire mat. Complete all four corner designs.

Count from I to J and mark. From J count a distance equal to I J and mark. Make similar marks until the corner is reached. Weave the design I L M J between all these marks. Space off each side of the mat in the same way and finish the design on all sides.

Mats woven for this design should be of the following sizes:

309 by 541—from A to B is 12 straws;
319 by 551—from A to B is 22 straws;
280 by 454—from A to B is 12 straws;
551 by 696—from A to B is 22 straws.

On mats of uncolored straw, the following colors may be used: No. 2, 3, 6, 9, 10, 15, or 16. (16 should not be used on sabutan.)

No. 14 for border lines and the four large spots in the side of each square; No. 3 for the remainder of the design.

No. 12 with spots and border lines of No. 3.

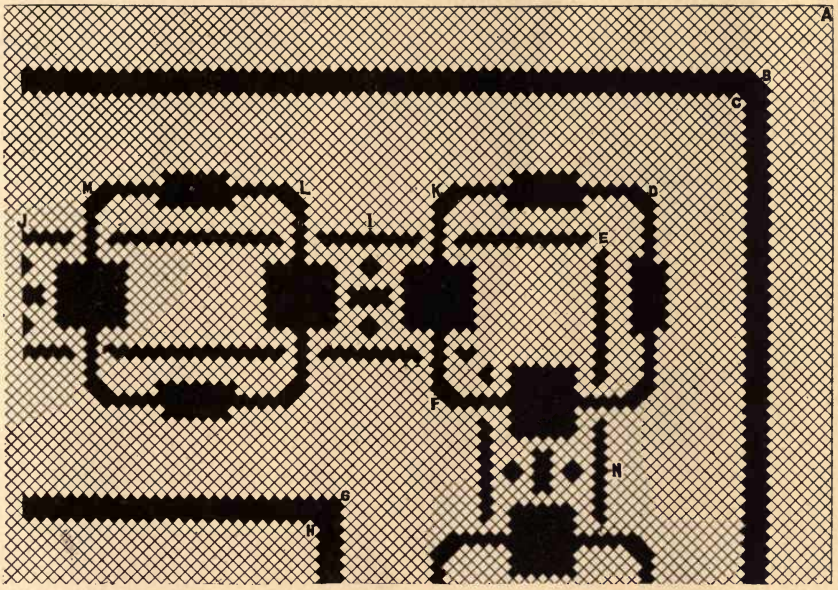

Plate LXVI. Geometric Design Z.

LARGE BANCA DESIGN.[3]

Distance from corner A to B is 41 straws;
from B to C, 2;
from B to G, 31;
from G to S, 5;
from C to D, 35;
from D to E, 2; and
from D to F, 10.

Begin weaving at letter B and weave the outer border line around the entire mat. Next weave the inside border line beginning at D.

[3] This design, in all cases except where G S is 8 instead of 5, would look well with the outer border line broadened to the edge of the mat. This is a suggestion only; it means a great deal of work.

After finishing the border lines, weave all four corner designs. Count from C to H, 9 straws;

from H to I, 5;
from I to J, 27;
from J to K, 5;
from L to M, 6; and
from N to O, 8.

Now weave from O to P. From P to Q is 4 straws, and from P to R is 7 straws.

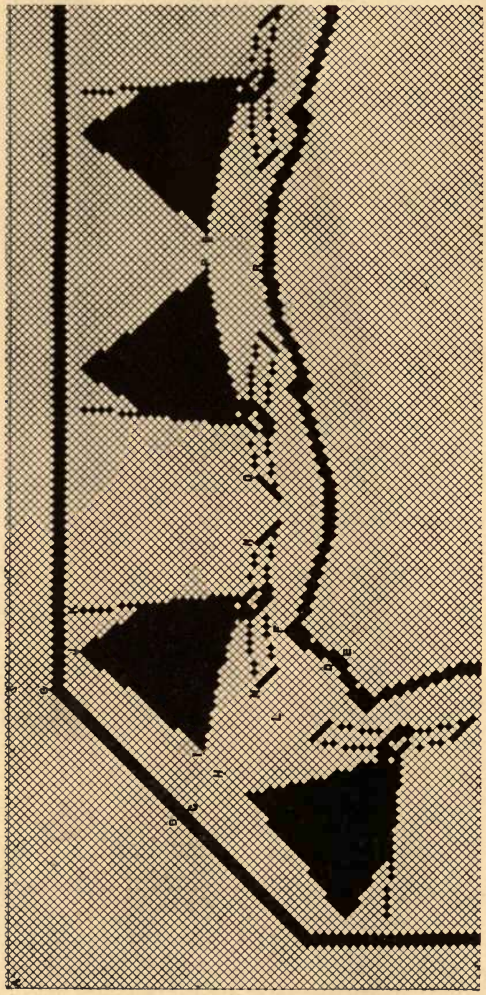

Plate LXVII. Large banca design.

Mats woven for this design should be:

239 by 425;
301 by 487;
301 by 549;
555 by 741.

In the last mat, 555 by 741, G to S is 8 instead of 5.

On ticug mats of natural straw this design may be embroidered in the following colors:

No. 2, 3, 6, or 15, solid.

No. 14 with border lines of No. 15 (except on sabutan).

No. 14 with border lines of No. 9.

CHICK DESIGN.

The distance from A to B is 50 straws (count first fold);

from B to C is 21;
from C to D is 6;
from D to E is 19;
from E to F is 7;
from F to G is 18;
from H to I is 5; and
from G to J is 54.

Count down from corner A to B and weave the corner design. Now weave all four corner designs. Begin at F and weave the inner border line entirely around the mat.

Count from F to G and weave the design above G. Count from H to I and weave the second design. Now count from G to J and weave the figure above J exactly like the figure above G.

Mats woven for this design should be 254 by 416, 308 by 524, 416 by 524, or 590 by 806 straws. The last mat has a change in margin, and the distance from A to B is 58 straws.

This mat may be embroidered in the following colors:

No. 3, 6, 10, or 15.

ORCHID DESIGN.

The distance from the corner A to B is 13 straws;
from B to C, 2;
from C to D, 19;
from D to E, 35;
from E to F, 17;
from C to F, 71;
from F to G, 2;
from G to H, 19;
from M to N, 6;
from F to M, 67;
from M to K, 13; and
from K to J, 19.

Begin weaving at B and weave the outside border line around the entire mat. Next count from C to F and weave the inside border line. Now weave

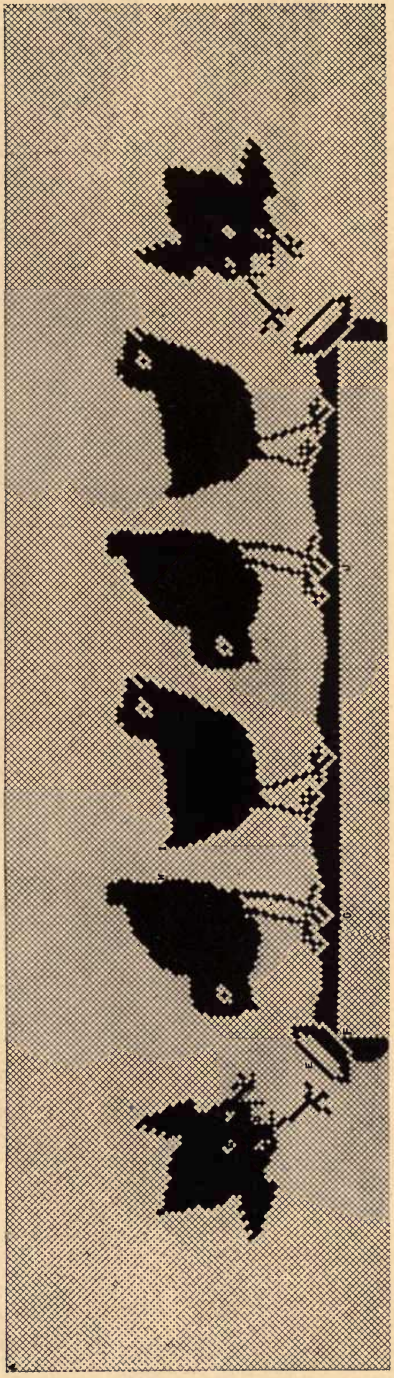

Plate LXVIII. Chick design.

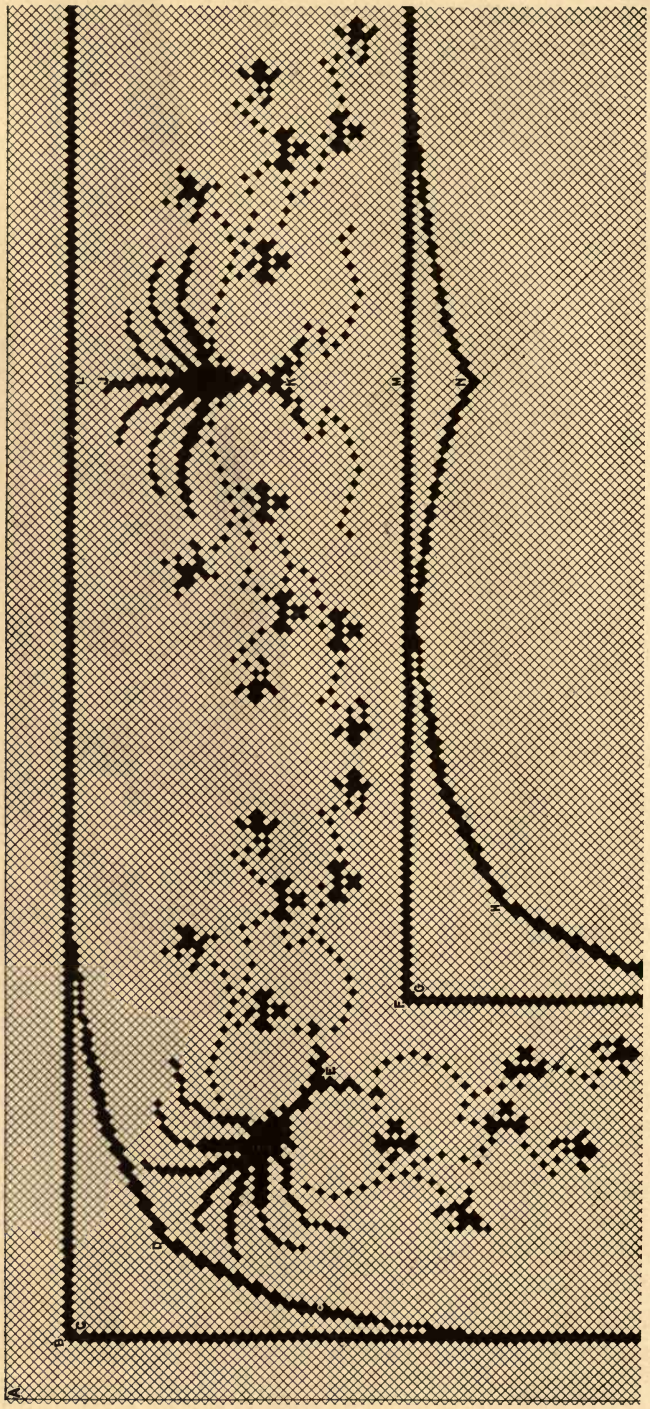

Plate LXIX. Orchid design.

all four corner designs. Count from F to M, then up to K, and weave from K to J.[4]

To find the position of the next design count 81 straws beyond L along the inner border line, and then up the same distance as L K.

Mats woven for this design should be 301 by 544; 220 by 382; 301 by 463; and 550 by 712 straws. In mat 550 by 712, A B is 17 straws.

In mats of natural color straw, the following colors may be used in the designs:

No. 2, 3, 6, or 15 solid.

No. 3 with flowers of No. 1 and border lines of No. 9 except on sabutan.

No. 12 with flowers of No. 7 and border lines of No. 15.

WOMAN CARRYING CLOTHES DESIGN.

The distance from A to B is 29 straws;
from B to C is 2;
from C to D is 36;
from I to J is 3;
from B to E is 11;
from E to K is 9;
from E to F is 21;
from F to G is 3; and
from G to H is 10.

Count from A, the corner of the mat, to B. At B begin to weave the border line. Weave first to E, then entirely around the mat.

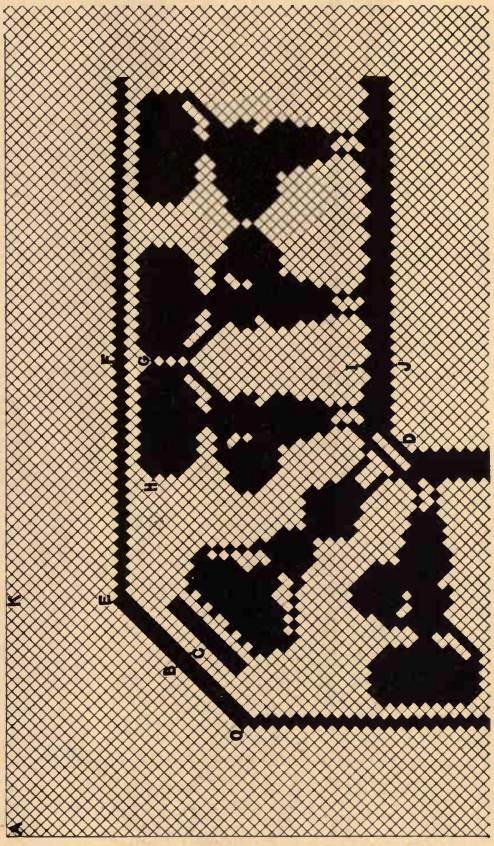

Plate LXX. Woman carrying clothes design.

Now count from C to D and weave the inner border line entirely around the mat. Next, weave in the four

[4] Weave large solid parts of designs first, when possible, and slight mistakes of one or two straws, which may happen, will then occur in open parts where they will show very little. Mistakes of this kind are only allowable in cases of flaws in the mat which is used.

corner designs. Count from E to F, then down to G. From G to H is 10 straws. Now weave the first two designs on the side and then the next two, and so on.

Mats woven for this design should be 300 by 392; 304 by 534; 254 by 346; or 568 by 706.

On all of these mats the design will look better if twice the size of the pattern. Therefore all the above distances will be double, or as follows:

A to B, 58 straws;
B to C, 4;
B to E, 22;
E to F, 42;
C to D, 72 straws;
I to J, 6;
E to K, 18;
F to G, 6.

In mat 304 by 534, E to K is 20 and A to B is 51 (already double). In mat 568 by 706, from A (corner of mat) to B is 39, making E to K 14 straws (already doubled).

This design in ticug straw will work up well in No. 5 solid; in No. 4 solid; in No. 3 solid; in No. 5 with No. 2 as inner and outer border line, or with No. 1 as inner and outer border line.

This design on sabutan straw may be made in No. 1 solid; in No. 2 solid; in No. 5 solid; in No. 6 solid; in No. 2 with No. 1 for border lines; in No. 4 with No. 1 for border lines; or in No. 5 with No. 1 for border lines.

This design will work up well in the following colors: No. 2, 3, 6, or 15.

LAVANDERA DESIGN.

The distance from A to B is 15 straws;
from B to C is 4;
from C to D is 40;
from D to E is 21;
from E to F is 3;
from F to G is 4;
from G to H is 3;
from D to I is 12;
from I to J is 13;
from I to K is 18;
from K to O is 5;
from O to L is 2;
from L to M is 26; and
from M to N is 28.

Count down from A to B and mark B and C. Place similar marks at the three other corners of the mat. Weave the border

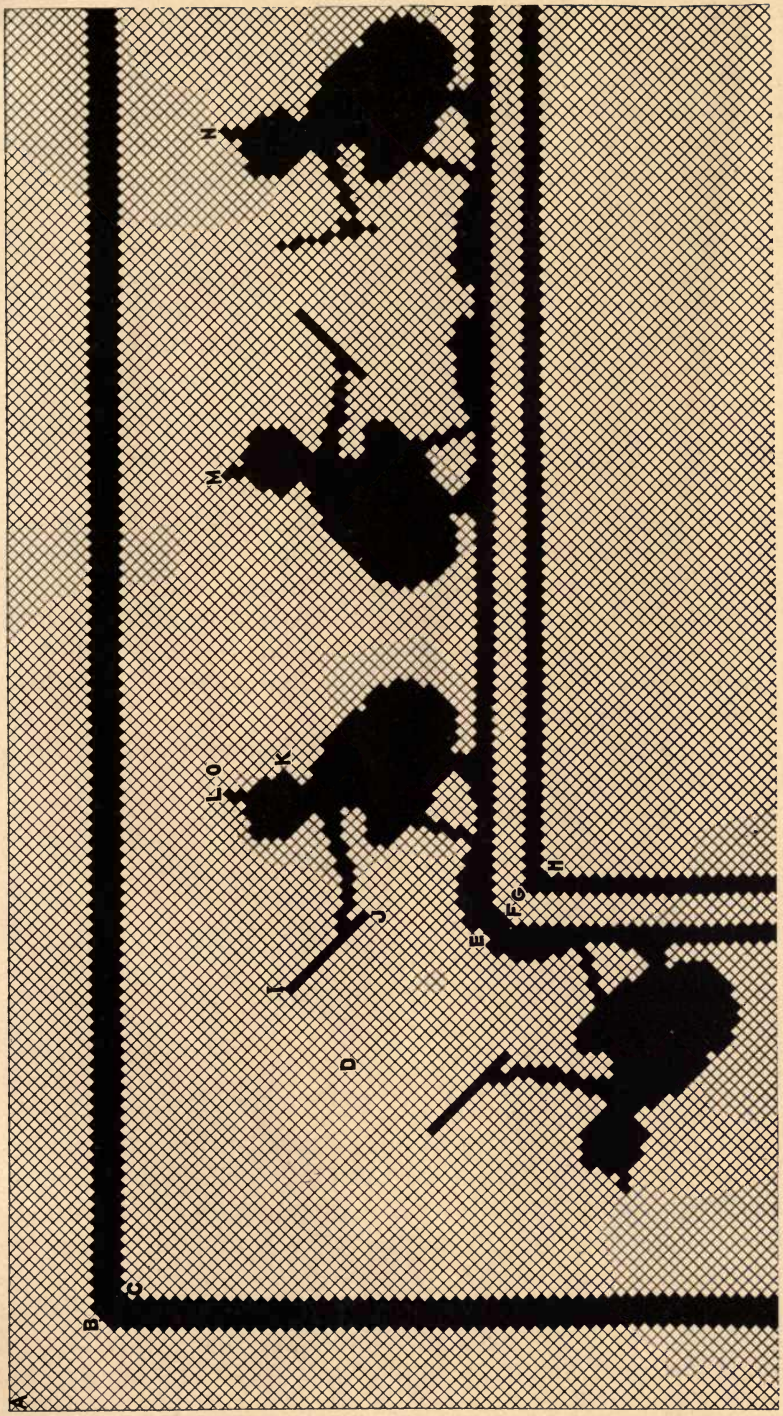

Plate LXXI. Lavandera design.

line around the entire mat, touching the marked points. Count from C to G, mark, and do the same in the other three corners.

Weave G H around the mat, touching the marked points at the corners. Count from C to D and over to I, and weave I J. Weave the whole figure just started, and the figure facing it, including the ground line beneath. Weave the other corners in a similar manner.

At K count to O, back to L, over to M, and weave the figure beneath M. Mark off L M and M N. Now continue marking alternately across the side spaces equal to L M and M N, making the last space equal to L M. Weave the figure between these marks and continue marking and weaving in the same way on the other sides.

Mats woven for this design should be made:

237 by 399;
345 by 507;
690 by 1014 (units double size);
453 by 615.

In ticug mats of natural straw the following colors may be used:

No. 2, 3, 6, 9, 10, 15, or 16, solid. (16 should not be used on sabutan.)

MAN WITH BOW AND ARROW DESIGN.

The distance from A to B is 20 straws;
from B to C is 2;
from C to D is 30;
from D to E is 17;
from E to F is 66;
from F to G is 3;
from G to H is $11\frac{1}{2}$;
from H to I is 9;
from J to K is 17;
from I to L is 33; and
from L to M is $14\frac{1}{2}$.

Count from A to B. At B weave the border band around the entire mat. Count from C to F (113) and weave the inner border line around the entire mat. Now weave all four corner designs. Count from G to H and up to I, and weave the two figures.

To place the next two figures, which are exactly like the two just woven, count out from J, 17 straws, and repeat from K which is the tip of the arrow of the first figure, just made.

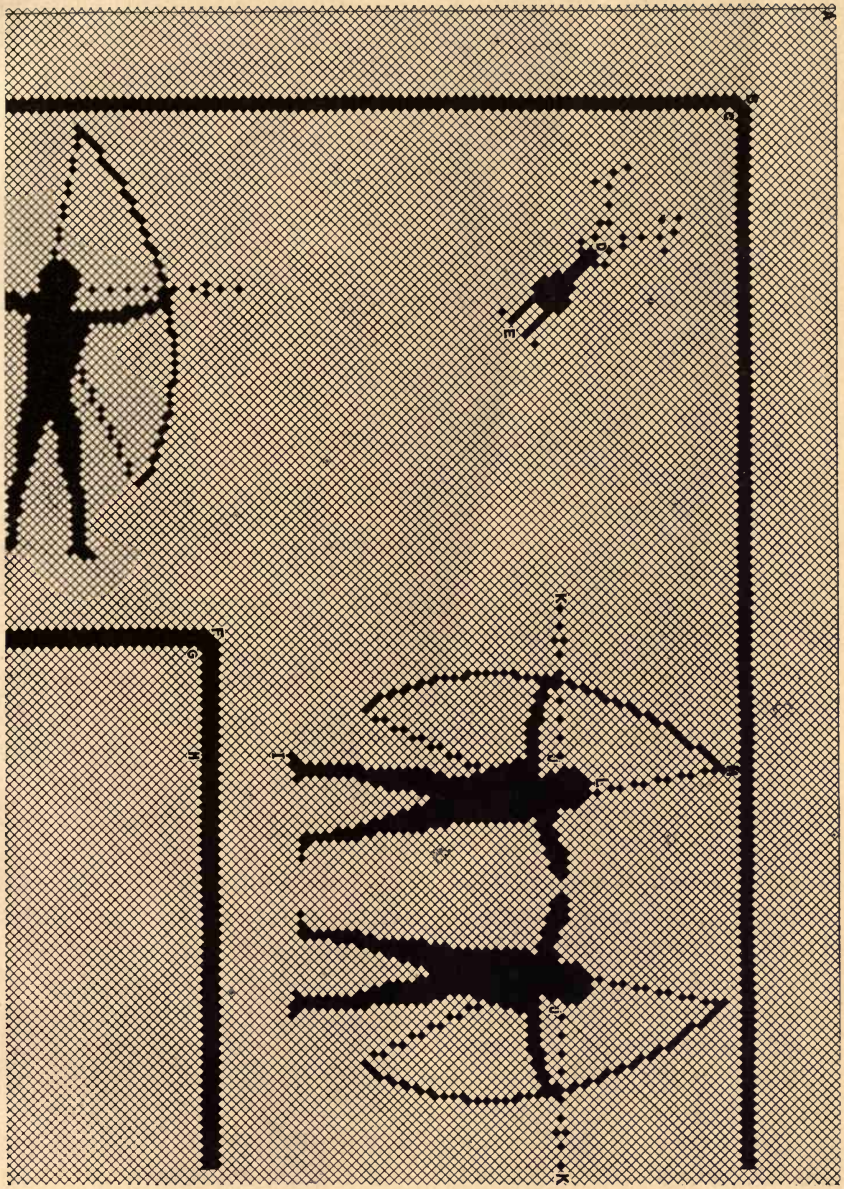

Plate LXXII. Man with bow and arrow design.

Mats woven for this design should be:

345 by 501, 9 straws;
505 by 739, 11;
739 by 1051, 11.

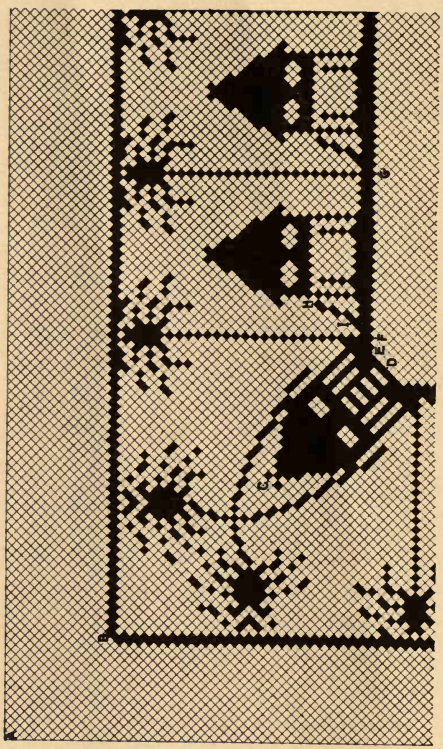

Plate LXXIII. Casa design.

In mats 505 by 739, and 739 by 1051, from A to B is 24 straws.

This design in tikug may be worked up in the following colors on natural color straw:

Solid, No. 2, 3, 6, 10, or 15.

CASA DESIGN.

The distance from the corner A to B is 22 straws;
from B to C is 33;
from C to D is 24; and
from F to G is 17.

Count down from A to B and weave border line around the entire mat. Now count from B to D and from D to E, $3\frac{1}{2}$ straws, and commence weaving the inner border line. When completed, weave in all four corner designs. Count from F to G and weave in the next design, and so on. Let H I, the steps, be on the left of every casa except the corner ones.

Mats woven for this design should be 254 by 407 straws; 271 by 424; 304 by 542 (double); 406 by 542 (double); or 576 by 712. In the last three of these, 304 by 542, 406 by 542, and 576 by 712, the counts should all be doubled, the designs being twice the size of those in the first two mats; that is, from A to B will be 44, B to C, 66, and so on.

Tikug mats in natural straw may be embroidered in the following colors:

No. 14 for casa, No. 12 for tree, No. 15 for border lines except on sabutan;

No. 3 for casa, No. 15 for tree, No. 8 for border lines; and Nos. 2, 3, 6, 9, 10, 12, 15, or 16, solid;

No. 16 should not be used on sabutan.

CHICKEN VENDER DESIGN.

The distance from the corner A to B is 15 straws, counting the corner fold as 1. All counts in this design are woven double.

Therefore from A to B is 30;
from B to C is 17 by 2 or 34;
from C to D is 44;
from E to G is 16;
from F to H is 14;
from B to D is 78;
from G to I is 24; and
from J to K is 30.

Notice that the space on the right of the corner is one less than the space on the left; this will occur on the right and left of each corner. Count down from corner A to B and weave a line entirely around the mat. Count from B to D and weave the inner border line. Now weave the basket in each corner. Then weave from G to I and J to K, and so on.

Mats woven for this design should be:
332 (7) by 512 (12)—from A to B is 30 straws;
260 (5) by 404 (9)—from A to B is 30;
260 (5) by 476 (11)—from A to B is 30; or
512 by 692 (17)—from A to B is 30.

On tikug mats of natural color this design may be embroidered in the following colors:

No. 2, 3, 6, 9, 10, 12, 15, or 16. (16 should not be used on sabutan).

No. 14 with a single straw outline and solid border lines of No. 9, 8, or 3.

No. 14 with outlines of No. 3 and baskets and hats of No. 1, except on sabutan.

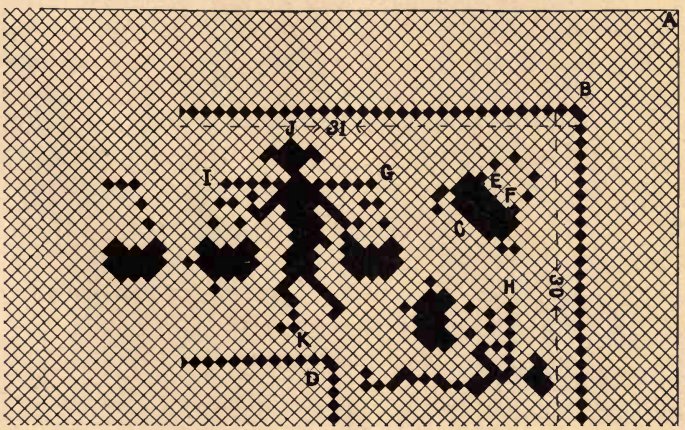

Plate LXXIV. Chicken vender design.

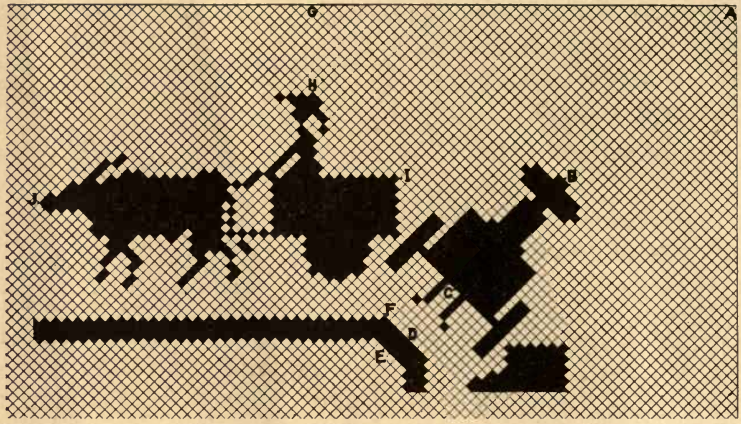

Plate LXXV. Carabao cart and driver design.

CARABAO, CART, AND DRIVER DESIGN.

The distance from A to B is 32 straws, but it must be woven twice that size, making A B equal 64.

All the sizes given below are double the count on the drawings:

from A to B is 64;
from B to C is 40;
from C to D is 18;
from D to E is 6;
from D to F is 8;
from A to D is 122;
from B to I is 30; and
from G to H is 16.

Count from the corner A to B and weave B C. Count from A to D and mark off D. Count from C to D and test the count. From each corner of the mat make a count similar to A D and mark. Weave the border line, commencing at D, around the entire mat, touching the marks at the corners. Weave design B C, and a similar design in each remaining corner. Count from B to I and weave design I J. At J count 2 and weave another design like I J facing I J. The space between the backs of the carts, not shown on this diagram, is 6.

Mats woven for this design should be in the following sizes:

258 by 396;
258 by 534;
396 by 534;
534 by 672; or
672 by 810.

In tikug mats of natural color straw the following colors may be used:

Singly, No. 2, 3, 6, 10, or 15; and No. 3 with border line of No. 9.

ROOSTER DESIGN.

The distance from the corner A to B is 13 by 2 or 26 (counts in this design are all double); from B to C is 28 by 2 or 56; from C to D is 5 by 2 or 10; from D to E is 26 by 2 or 52; from E to F is 3 by 2 or 6; from E to O is 3; from O to G is 11; from H to J is 11; from G to H is 56 by 2 or 112.

Count from A to B in all four corners and mark B in each corner. Join all the B's by a double border line. At the first B, count down to C and over to D and weave D E. Count from E to O and up to G and mark. Mark H, counting from G. Mark J, counting from H. Mark all points similar to H and J on this side of the mat, counting back from the corner a space equal to G B. Now weave all designs on this side of the mat. Mark off spaces on each side of the mat before weaving that side.

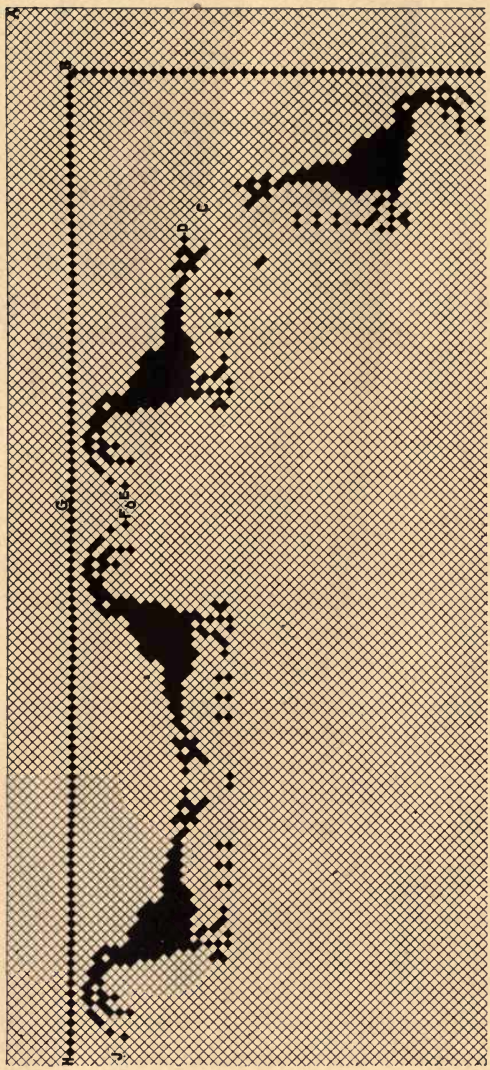

Plate LXXVI. Rooster design.

Mats woven for this design should be 202 by 538; 314 by 538; or 426 by 650.

In tikug mats of natural color straw the following colors may be used:

No. 2, 3, 6, 10, 15, or 16. (16 should not be used on sabutan.)

No. 3, cock; No. 14, comb, (three squares from I to C and two above M); No. 1, legs and feet; No. 15, grass and other

border line. (On sabutan use No. 14 instead of No. 1 for legs and feet).

CARABAO HEAD DESIGN.

The distance from A to B is 25 straws;
from B to C is 3;
from C to D is 23;
from D to E is 3;
from E to F is 4;
from F to G is 11;
from G to H is 31;
from F to I is 22;
from H to J is 3;
from I to K is 37;
from L to M is 11;
from I to N is 12;
from N to O is $12\frac{1}{2}$; and
from I to P is 7.

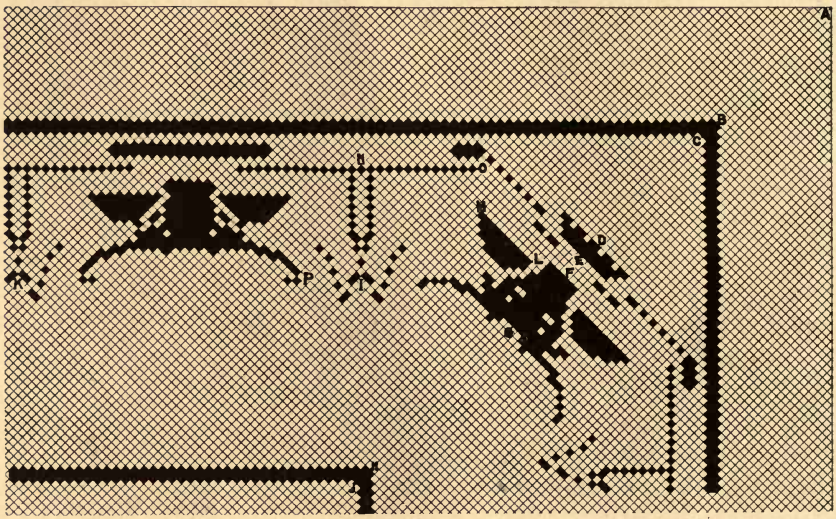

Plate LXXVII. Carabao head design.

Count from the corner A to B and mark. Count the same number in from every corner and mark. At B weave the border line the thickness of B C around the entire mat, intersecting the marks at the other three corners.

Count C D and weave the corner design D G. Count from G to H and mark. Count from B to H and see if the mark is correct. Mark off B H in the other three corners and weave the border line H J around the entire mat. Now weave the

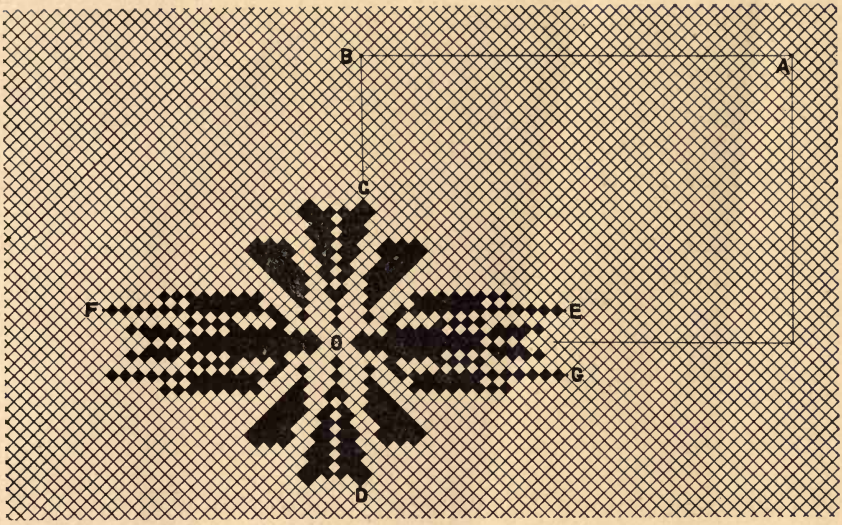

Plate LXXVIII. Detail of fishtail palm design.

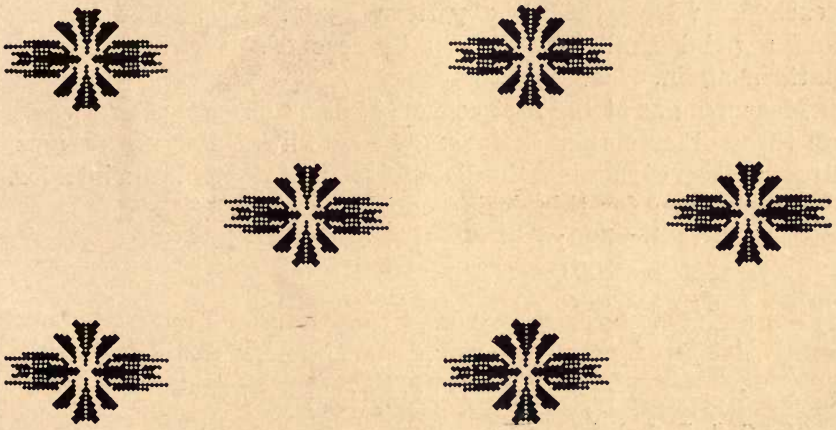

Plate LXXIX. Arrangement of fishtail palm designs.

other three corner designs. Count from F to I and mark. Count from I to K and mark.

From K on, mark off distances like I K along this side of the mat until the last point is reached. The remaining space to the point similar to F will equal I F. Now weave the intervening designs, and complete the mat.

Mats woven for this design should be of the following sizes:

319 by 541;
257 by 405;
490 by 712; or
393 by 541.

In tikug mats of natural color straw the following colors may be used:

No. 3, carabao and all border lines; No. 15, grasses.
No. 2, 3, 6, 9, or 15.

FISHTAIL PALM DESIGN.

This is an "all over" design. The unit counts are as follows:

from A to B is 33 straws;
from B to C is 11;
from C to D is 22;
from E to F is 35;
from E to G is 5.

From the corner of the mat, A, on the long edge, count down to B. At B count in to C. Mark C O D E F and weave the design. From D count 44, and a point similar to C will be reached. Weave the same pattern again. From F count 55, and a point similar to E will be reached. Weave the same pattern again.

Measuring as at the first corner A, mark off spaces and weave all three other corner designs. Weave all intervening designs, first between corners on the sides of the mat, then on the interior.

Mats woven for this design should be:

374 by 520;
506 by 700;
572 by 790;
638 by 880.

In tikug mats of natural straw, the following colors may be used separately, not in combination:

No. 2, 3, 5, 6, 9, 10, or 15.

BUREAU OF EDUCATION PUBLICATIONS—Continued.

(*Continued from second page of cover.*)

BULLETINS—Continued.

36. Catalogue and Announcement of the Philippine Normal School. May, 1911. (Edition exhausted.)
37. School Buildings, Part I. 1912.
38. School Buildings, Part II. 1912.
39. A Manual of Free-hand Drawing for Philippine Primary Schools. (In course of preparation.)
40. Athletic Handbook for the Philippine Public Schools. (Now being revised.)
41. Service Manual of the Bureau of Education, 1911.
42. Intermediate English. II—Notes, Directions, and Aids to the Preparation of the Correspondence Study Course, 1911.
43. Catalogue of the Philippine School of Arts and Trades, 1912.
44. Libraries for Philippine Public Schools.
45. The School of Household Industries, 1912.
46. Industrial Museum, Library, and Exhibits of the Bureau of Education.
47. Good Manners and Right Conduct, for Use in Primary Grades.
48. A Course in Civics. (In course of preparation.)
49. Philippine Industrial Fibers. (In course of preparation.)
50. Arbor Day and School Holidays. (In course of preparation.)
51. The Philippine School of Commerce. 1913.
52. The Philippine School of Arts and Trades, Nautical Department. 1913.

CIVICO-EDUCATIONAL LECTURES:

1. The Rights and Duties of Citizens of the Philippines. 1910. (Supply limited.)
2. The Prevention of Diseases. 1910. (Supply limited.)
3. Rice. 1910. (Supply limited.)
4. Diseases of Animals. 1910. (Supply limited.)
5. Coconut Beetles. 1910. (Supply limited.)
6. The Housing of the Public Schools. 1910. (Supply limited.)
7. Coconuts. 1911.
8. Corn. 1912.

THE TEACHERS' ASSEMBLY HERALD:

Volume I, 1908. (Edition exhausted.)
Volume II, 1909. (Edition exhausted.)
Volume III, 1910. (Edition exhausted.)
Volume IV, 1911. (Supply limited.)
Volume V, 1912. (Supply limited.)
Volume VI, 1913. (Now current.)

THE PHILIPPINE CRAFTSMAN:

A monthly school industrial magazine. Now current.

TEXT-BOOKS:

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